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W. J. HOLLAND, *Editor*

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ERRATA AND CORRIGENDA.

- P. 4, 6th line from bottom read *Lebrun* for Leborne.
P. 80, read *Pelecypoda* for Pelycypoda.
P. 86, interchange figures 2 and 3, and reverse position of figure 4
P. 87, line 25, read *from* for form.
P. 119, line 26, read *median* for medium.
P. 151, bottom line, read *Actinoptera* for Actinopteria.
Pp. 151 and 159, read *Ascodictyon* for Ascodictyum.
Pp. 151 and 164, read *D. sculptilis* for sculptis.
P. 152, read *Primitia* for Primita.
P. 152, read *Cyclonema hamiltoniae* for C. hamiltonensis.
P. 157, read *C. tenuistriata* for tenuistriatus.
P. 159, line 16, read *Autodetus* for Autodetes.
P. 164, 4th line from bottom, read *eboraceum* for eborasceus.
P. 168, line 6, read *Chonetes* for Chonetus.
P. 169, line 9, read *Pelecypoda* for Pelycypoda.
P. 169, line 17, read *Nuculites* for Nuculitus.
P. 172, read *carinatum* for carinatus.
P. 173, read *Thetis* for Thetys.
P. 174, 9th line from bottom, read *ornata* for ornatas.
P. 189, line 2, read *Acanthosoma* for acanthosoma.
P. 328, line 26, p. 329 *et seq.*, read *Remopleurides* for Remipleurides.
P. 333, line 1, read 1862 for 1861.
P. 333, last line, p. 375 *et seq.*, read *Ruedemann* for Ruederman.
Pp. 336 and 337, read *Archinacella propria* for *A. proprius*.
P. 342, lines 9, 21 and 31, omit *species*.
P. 367, 5th line from bottom, insert (*Billings*) after *Pseudosphærexochus vulcanus*.
P. 371, 6th line from bottom, *et seq.*, read *Sphærocoryphe* for Sphærocorphe.
P. 373, read *Apollo* for Opollo.
P. 379, line 20, read *Kittatiny* for Kittating.
P. 381, 8th line from bottom, read *Harpina ottawaënsis* for *Harpina ottowaënsis*.
P. 418, 25th line, read *Cleiothyris* for Cleiothyrsus.
P. 423, read *euomphalus* for euomophalus.
P. 497, 9th line, read *prinioides* for primoides.
P. 534, read *plauta* for *plautus*.

ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME III. NO. 1.

EDITORIAL.

THE unfortunate death of Mr. J. B. Hatcher has made it necessary for the Director of the Museum to temporarily assume the direct oversight of the department of Paleontology in the Museum. The work in this Section will be carried on as usual, and, until such time as a successor shall have been chosen to fill Mr. Hatcher's place, all correspondents and others having relations with the paleontological work of the Museum are requested to address their communications to the Director of the Museum.

Three expeditions are in the field at the present time, one in northern New York, under Mr. Percy E. Raymond; another in Nebraska, under Mr. O. A. Peterson, and a third in Montana, under Mr. W. H. Utterback. All these gentlemen report themselves as highly successful in their work, and the result may confidently be expected to be a considerable accession of valuable material to the collections of the Museum.

FROM Mr. Charles R. Knight the Museum has received a painting, 40 x 32 inches in size, representing Triceratops. The painting was executed by Mr. Knight under the supervision of Mr. J. B. Hatcher, and a reproduction will be one of the plates in his Monograph on the Ceratopsia. The painting has been framed and is on exhibition in the Museum. It is interesting in this connection to know that the

expedition under Mr. Utterback in Montana has recovered two fine skulls of *Triceratops*.

HIGHLY appreciative comments upon Mr. W. E. C. Todd's paper upon the Birds of Erie and Presque Isle, recently published in the ANNALS have been received from many quarters. It is hoped, that, as one of the results of the agitation begun by Mr. Todd and the authorities of the Carnegie Museum, the wholesale slaughter of birds at Erie, Pa., may hereafter, to some extent at least, be checked.

THE Anthony collection of birds has been unpacked and is gradually being arranged. The purchase of this collection, as has already been noted, adds about ten thousand specimens to the collection of birds in the Carnegie Museum.

NOTHING more absurdly false than the report of the Secretary of the Pennsylvania Game Commission to that body, made on July 7, could be imagined. In his report he attacks the authorities of the Carnegie Museum, asserting that they have been guilty of wanton and excessive destruction of bird life within the limits of the Commonwealth. The Secretary failed entirely to make a proper investigation, declining to avail himself of the opportunities which were freely accorded him to do so, asserting his belief in the entire integrity of the management of the Museum. He then turned around and wrote his report, which is a tissue of misstatements from beginning to end, and gave it to the newspapers for publication. The allegation made by Joseph Berrier, game warden, that the ornithologists of this Museum had taken forty thousand birds within the limits of the Commonwealth, and the allegation of Dr. Joseph Kalbfus, that he had been informed by Mr. Todd that they had killed twenty-three thousand birds, are utterly untrue. As an actual fact at the time Mr. Kalbfus made his pretended investigation the whole number of North American birds contained in the Museum which could by any construction be attributed to the soil of Pennsylvania, was only three thousand three hundred and seventy-three specimens, of which total number sixteen hundred and eighty-three are birds collected during the last nine years by the ornithologists of the Museum within the limits of the Commonwealth, the remainder being specimens donated

or purchased from older collections. The authorities of the Museum have demanded a full and prompt investigation of the whole matter, that the entire falsity of the charges made against the Museum can be demonstrated. The ornithologists of America have been the leading promoters of all movements looking toward the preservation of bird life, and have done more to protect the avifauna of the country than all other agencies combined. The ornithologists of the Carnegie Museum have not been behind their brethren in their efforts to preserve and protect bird life, and to charge them with the wanton and wholesale butchery of birds is to utter a libel against them, as can be easily demonstrated.

THE formal presentation of the reproduction of the skeleton of *Diplodocus carnegii* has upon conference with the Director of the British Museum and Mr. Carnegie been deferred until May, 1905. The reason for not installing the specimen in the British Museum in August of the present year, as was originally proposed, is the fact that at that time it would have been impossible to secure a representative gathering of the Trustees of the Museum and of other scientific men as was desired by Professor E. Ray Lankester, and no other date could be fixed which would entirely suit the convenience of Mr. Carnegie until the time designated. The restoration has been completed and the bones are to be shipped to the British Museum, where they will be kept until arrangements can be made for the erection of the skeleton upon the site which has been designated in the Hall of Reptiles.

A NUMBER of beautifully mounted specimens of mammals have been prepared for exhibition by Messrs. Webster and Lockwood. The arrangement of these exhibits in anything like scientific order is at present impossible owing to the crowded condition of the exhibition cases. All this will be remedied in the new building, the foundations for which are being laid.

THE entomologists of the Museum have been making extensive collections of the micro-lepidoptera of Western Pennsylvania. A number of beautifully prepared specimens have been secured and a substantial beginning has been made looking toward the formation of a complete collection of these interesting, but little studied creatures.

PROFESSOR ORTMANN has been conducting extensive inquiries into the geographical distribution of the fresh water crustacea of the upper Ohio Valley. He reports a number of interesting discoveries, and has decided that one species found in the region is new to science.

MR. C. V. HARTMAN is laboring diligently upon the preparation of his report upon his Costa Rican explorations. The results will be published in the *Memoirs* of the Museum.

MR. O. E. JENNINGS has made a large number of excursions to various points of interest in the western half of the Commonwealth for the purpose of collecting the plants of counties which hitherto have been but partially explored by the botanists of the Museum. The result has been the acquisition of a large quantity of valuable material and the discovery of one or two species which are regarded as possibly new to science.

MR. D. R. SUMSTINE, who is carrying on his work among the fungi, also reports several new species.

VERY appreciative accounts of the work of the Carnegie Museum have recently appeared in the *Museums Journal*, the organ of the Museums Association of Great Britain, and in an account published by Mr. A. B. Meyer of the Royal Museum at Dresden. Professor Meyer dwells at length upon the method of interesting the children of the schools in Museum work through the agency of "The Prize Essay Contest." He had before him as the time he wrote the Report of 1902. Referring to the essay on Bird Life, to which was awarded the first prize in that year, he says that it is "*besonders hübsch*" — particularly pretty. A still more complete and appreciative review of the work of the Carnegie Museum from the graceful pen of Dr. Hector Leborne, of Brussels, has appeared in one of the Belgian magazines, and has been widely circulated in that country.

APPRECIATIVE tributes to the memory of the late Professor J. B. Hatcher have been published in a number of the scientific journals, and his loss is universally deplored as a great blow to the science of paleontology.

I. MINUTE (OR ORDER) BOOK OF THE VIRGINIA COURT
HELD FOR OHIO COUNTY, VIRGINIA, AT BLACK'S
CABIN (NOW WEST LIBERTY, W. VA.), FROM JANU-
ARY 6, 1777, UNTIL SEPTEMBER 4, 1780, WHEN ITS
JURISDICTION OVER ANY PART OF PENNSYLVANIA
HAD CEASED.

EDITED BY BOYD CRUMRINE, OF WASHINGTON, PA.

INTRODUCTION.

There have now been published the Minutes of the Virginia Court held for the District of West Augusta, first at old Fort Dunmore, now Pittsburgh, Pa., and for a while at Augusta Town, now Washington, Pa., 1775-1776 (*Ann. Car. Mus.*, Vol. I, pp. 525-568) and also the Minutes of the Virginia Court held for Yohogania County, first at Augusta Town, and afterwards on the Andrew Heath farm, near West Elizabeth, 1778-1780 (*Id. c.*, Vol. II, pp. 71-140, and pp. 205-429).

As stated in Vol. I, on p. 524, the Minute- or Order-books of the Court held for Monongalia County, at the house of Theophilus Phillips, on George's Creek, in the southern part of what is now Fayette County, Pennsylvania, were destroyed on the burning of the Court House at Morgantown in 1796. Therefore, the records of that Court, having jurisdiction over the southern part of what is now Fayette County, the southeastern part of the present Washington County, and more than half of the eastern part of the present Greene County, Pennsylvania, cannot now be reproduced. But, fortunately, when the Court for Ohio county, Virginia, was removed from Black's Cabin, on Short Creek, to Wheeling, in 1797, its records also were removed and are still to be found in the office of the Clerk of the County Court, in the Court House for Ohio County in that city.

These records of Ohio County, much used for over one hundred and twenty-five years, are in many places almost illegible, notwithstanding the great care that has been taken to preserve them; yet, because of the fact that, until the Virginia jurisdiction was entirely

withdrawn from Pennsylvania, a large part of the territory in what is now Washington and Greene Counties, Pennsylvania, was within the jurisdiction of the Ohio County Court, of Virginia, it is proper that so much of these records as were made prior to August 28, 1780, when the last term of Court was held for Yohogania County, should also be published.

The Act of the Virginia Assembly of October, 1776, which divided the District of West Augusta into the three new counties, Ohio, Yohogania, and Monongalia, also established the boundary line between the County of Augusta and the District of West Augusta, which line had before that time been undefined. It was then defined as follows :

“Beginning on the Allegheny mountains between the heads of the Potowmack, Cheat, and Green Briar Rivers ; thence along the ridge of mountains which divides the waters of Cheat river from those of Green Briar, and that branch of the Monongahela called Tygers Valley river, to the Monongahela river ; thence up the said river and the west fork thereof to Bingeman’s creek, on the northwest side of the said west fork ; thence up the said creek to the head thereof ; thence in a direct course to the head of the Middle Island creek, a branch of the Ohio, and thence to the Ohio, including all the waters of the said creek in the aforesaid District of West Augusta ; all that territory lying to the northward of the aforesaid boundary, and to the westward of the States of Pennsylvania and Maryland, shall be deemed and is hereby declared to be within the District of West Augusta.”

Then follow the provisions establishing out of the District of West Augusta the new counties of Ohio, Yohogania, and Monongalia, and the division lines between them, as quoted in Vol. II, p. 74 of these ANNALS.¹

By reference to our map of the District of West Augusta, facing p. 518, Vol. I, of these ANNALS, studied in connection with the division lines of the three new counties made from said District, as shown in Vol. II, p. 74, it will be seen that the northern end of the present “Panhandle” of West Virginia, was put into Yohogania County. But on the settlement of the boundary controversy by the

¹ For the entire act and other interesting matters relating to the subject, see Crumrine’s History of Washington County (1882), p. 183 and notes.

Baltimore Conference of 1779 (Vol. I, p. 522, of these ANNALS), the portion of Yohogania County north of Cross Creek was at first put into Ohio County, and subsequently became Brooke County.¹

It will also be seen that Ohio County, as originally created, extended northward to the mouth of Cross Creek, southward to the mouth of Middle Island Creek, and from the Ohio River, eastward, so as to include the present townships of Hopewell, Independence, Buffalo, Blaine, Donegal, East Finley, and West Finley, and parts of Canton and Franklin in Washington County, as well as perhaps the western one-third of Greene County, Pennsylvania. Thus it was that a large part of the transactions of the early Ohio County Court of Virginia related to the business and protection of inhabitants of Washington and Greene counties, Pennsylvania.

Black's Cabin where the first courts of Ohio County were held, was on the north fork of Short Creek, about eleven miles northeast from Fort Henry, now Wheeling, and about six or eight miles northwest from West Alexander, in Washington County, Pennsylvania. There was Vanmeter's Fort, and not far away was Rice's Fort on Buffalo Creek in Washington County, Pennsylvania; and Beeman's and Ryerson's stations in Greene county, and Fort Jackson, now Waynesburg. And it will be remembered that in the days of this early court, before Washington, town or county, was thought of, the people who looked to it for protection to their lives and property were on the frontiers of civilization; across the Ohio was a wilderness of savages, the enemies of civilization. Our present knowledge of events in these times will be freshened and confirmed by entries made in the course of judicial business shown in these records.

Ohio county, Virginia, like Washington County, Pennsylvania, has been shorn of its magnificent proportions. Its southern part has been made into a number of new Virginian (now West Virginian) counties, and its northern part, above the mouth of Short Creek, has been divided into Brooke and Hancock counties, while, by the actual running of the western boundary of Pennsylvania, in 1784-5, it lost all its old possessions in Pennsylvania.

Following the records of the early Ohio County Court we shall later give the contents of a small manuscript volume containing the

¹ See History of Augusta County, Va., by J. Lewis Peyton, p. 177.

records of deeds, etc., proved before the court for the district of West Augusta, 1775-1776, and ordered to be recorded. The records referred to embrace conveyances made by many of the early settlers, and include permits by the commandant at Fort Pitt, for the occupancy and cultivation of portions of the "King's Orchards," etc., and will be very interesting to the student of the early history of Pittsburgh and its vicinity.

ORDER-BOOK NO. I.

BLACK'S CABIN, OHIO COUNTY, Jan. 6th, 1777.

- (1) In pursuance of an order of the General assembly of this Commonwealth for the division of the district of West Augusta into three distinct Counties, whereof the County of Ohio is one distinct & separate County, Agreeable to its Circumscribing Boundaries ;

In Compliance with which & Certain other Instructions directed to John M^cColloch, Esq., directing him, the s^d M^cColloch, to summon the several landholders within s^d County to meet at the house of Ezekiel Dewits on Buffalo Creek, on the 27th of Decemb^r. last, as well for the purpose of Electing & Constituting a Committe in & for the s^d County, as for the making Choice of the seat for County Coart to be held at in future, within s^d County, which was done accordingly ; & a Majority determin'd in favour of a place known by the name of Black's Cabbin, on the waters of Short Creek, to be the place of holding Coarts in future.

Accordingly & in Compliance with a Certain writ of *dedimus potestatom*, directed to Will^m Scott, James M^cMechen, & David Rodgers, Impowering eighther of them to administer unto Mesrs. David Sheepherd, Silus Hedges will^m Scott & James Caldwell, the oath of Justice of the peace within s^d County; therefore the Commission being red at Blacks Cabbin afores^d James M^cMechan there did on Monday the sixth of this Instant, did administer unto s^d David Sheepherd, Silus Hedges, W^m Scott & James Caldwell the oaths of Justice of the peace, who being duly qualified the aforesaid Sheepherd did administer unto Messrs. Zachariah Sprigg, Thomas Waller & Dan^l M^cClain

the said oath of Justice of the peace, who being duly qualified took their seats on the Bench accordingly.

Whereupon, the Court Being sworn, Jn^o McColloch, Esq. as high sheriff of said County, then did offer Messrs. John Mitchel & Sam^l McColloch, Boath of this County, as sureties for the due executing the office of Sheriff within this County, who being accepted a Bond for that purpose was then accordingly executed in open Court. Likewise another Bond of one thousand pounds Conditioned for his faithfully Collecting & duly accounting for all officers fees & Cetera & producing Mes^{rs} Jn^o Mitchel, Sam^l McColloch & James McMechen, as Sureties, who being likewise accepted & approved & a Bond for that purpose was likewise accordingly executed, & the s^d McColloch took the oath of office in open Court.

- (2) The Court then proceeded to the choise of a Clark, & James McMechen being approved of for that purpose & having taken the usual oath took his seat at the Clark's table accordingly

The Court then advertng to the expediency that the Militia of this County should be under the best of Regulations and discipline, came to the following resolutions viz: that David Sheephherd, Esq^r be recommended to his honour the Governour as County Lieutenant in and for this County, & Silas Hedges Esq as Colonel, & M^r David McClure as Lieutenant Colon^l, & M^r Sam^l McColloch as Major of Militia.

The Court then adjourned untill tomorrow at eight of the Clock.

D. SHEEPHERD.

The Court met according to adjournment; present David Sheephherd, Silas Hedge, Will^m Scott, James Caldwell, Zachariah Sprigg, Tho^s Waller & Daniel McClain, Gentlemen.

Furthermore it is ordered by the Court that Joseph Tumlinstone, Sam^l Mason, Jn^o Mitchel, Joseph Ogle, Sam^l Teter, David Williamson, Jacob Lefler, James Bochanen & Reasin Virgin be likewise Recommended to his honour the Governour as Captains of the Militia; & that Mes^{rs} Dan^l McClain, Thomas Ryan, John Biggs, Derick Hoaglin, Thos Clark, James Gillaspay, Charles Bonner, James Pattin & Jn^o Boggs be recommended as Lieutenants; and that Mess^{rs} Morgan Jones, Moses William-

son, Jun^r, William Biggs, Andrew Fouts, Isaac Tayler, Hinry Taylor, John Hanley, David English & Isaac Phillips be likewise recommended as Ensigns.

& Foreasmuch as the tract of land agreed upon for holding Coarts at in future doth of right appertain unto Abraham Vanmetre of Opechan Creek in the County of Bartley, Order^d, therefore, that Zachariah Sprigg, Silas Hedges, Esq^r, be appointed to Contract & Covenant with s^d Vanmetre for not less than Two acres of s^d Tract Including the Cabbin & spring, In behalf of this County, for the purpose of erecting & Building thereon a Coart house, Prison and other necessary publick Buildings, for any sum not exceeding Twenty pounds, & Report make of their proceedings therein as soon as may be to this Coart.

(3) & Whereas it may be expedient that Constables should be [appointed] within this County, Ordered therefore that John Caldwell, Stephen Parr, Tho^s Williamson, Eliazer Williamson, John Bodkin, Tho^s Clark, Dan^l Morgan be summoned to attend our next County Coart, then and there to be sworn in as Constables ; But if any of the above Recited persons shall think it expedient to Qualify in as Constables before the next Justice of the peace, there attendance at Coart is hereby Remitted Respectively.

Ordered that Cap^t Sam^l Mason, Lieu^t. Ebenezar Zane, James McConnel, & Conrad Wheat, being first sworn, do view the best & most direct way for the laying out a Road from Fort Henery to the first fork of Wheeling, & thereupon due return make to our next County Court.

Ordered that this Coart be adjourned until Coart in Coarse.

DAVID SHEEPHERD

At a Court held in and for the County of Ohio on the third day of March 1777, present David Sheepherd, Silas Hedges, Zachariah Sprigg, William Scott, James Caldwell, Gentlemen.

David Rodgers took the oath of Justice of peace & took his seat on the Bentch According.

Mess^{rs} Ebenezar Zane, Conrad Wheat & Sam^l Mason, agreeable to a former order of this Coart for the purpose of laying

out the best and most direct way for a Road from fort Henery to the first forks of Wheeling, Reported as follows viz : from Fort Henery over the Ridge to the lower end of Mason's Bottom ; thence up the Creek Bank to wheet's Narrows ; thence to the top & along the north side of Wills' ¹ Nobb to a Blas'd white walnut on Will's old Road ; thence to the upper end of Wills field on the Creek Bank ; thence up the Creek Bank to Hawkins's old house ; thence to a blas'd white oak on Williamson's Road ; thence to the forks of Wheeling.

Ordered that Conrad Wheat be appointed an overseer of s^d road & that the Tithables on three miles of each side be summoned to work thereon until the same be completed.

- (4) Henry Nelson Came into Court and Complains that W^m Sparks had in an illegal manner taken away his Child & unjustly detains the same without his consent. Ordered that the s^d Sparks be summoned to attend our next Court & answer make to the above complaint

Ordered that James Fitzpatrick, an orphan Child, be bound unto Sam^l Bruce to learn the art and Mystery of a Taylor until he shall arrive to the age of Twenty one years.

Order'd that Isaac, Tade, & hannah, Melatto orphan Children, be bound unto David Rodgers, Esq^r. until the boys shall be of the age of Twenty one years, & the girl untill she be of the age of Eighteen.

Ordered that Robert Henderson, a Retaken prisoner amongst the Indians, be bound unto David Rodgers, Esq^r. until he be of the age of Twenty one years, to learn the art and Mystery of a weaver. But provided any parent or near Relative should appear, further ordered that said Rodgers yield up s^d Child, the parent or Relative paying Reasonable Costs & Expenses.

Ordered that this Coart be adjourned untill Coart in Coarse.

DAVID SHEEPHERD

At a Court held in and for the County of Ohio on Monday 7th of Aprile, 1777 ; present Silas Hedges, William Scott, Daniel McClain, David Rodgers, Gentlemen.

This Coart is adjourned till Tomorrow at eight of the Clock.

SILAS HEDGES.

¹ It is hard to decide from chirography of the original whether this is *Mills* or *Wills*.

The Court met according to Adjournment ; present Silas Hedges, David Rodgers, Zacharia Sprigg, Daniel McClain & Tho^s Waller, Gentlemen.

Isaac Tayler took the oath of subsheriff in open Court.

William Hawkins acknowledged a Bill of sale made unto Jn^o Wilson in open Court & ordered that the same be Recorded.

W^m Sparks appeared before this Court, & having not had an opportunity of Convening his Evidence ordered that it lay over unto the next Court & that the Child Continue in the Care of W^m Sparks untill that time.

(5) Jn^o Walker appeared Before this Court & answer made to the Complaint Jn^o O'Fin, with respect to the property of a Certain Bed ; whereupon the Coart having duely Considered the matter & Evidence, ordered that the Sheriff be order'd to give up to Jn^o Walker the Bed in dispute as his property, & that Judgment & execution be Issu'd against the s^d O'Fin for the Costs ; & further that, whereas the afores^d O'Fin has not produced to this Coart sufficient Evidence to support the Charge against s^d Walker, ordered that it be dismiss'd as Litigious.

Winney Price Came into Coart & made Complaint that she was unjustly detained in service by her Master Jn^o Mitchel ; the Court having Considered the matter agreeable to the Evidence that appeard orderd that the Case lay over till the next Court and that she Continue in the service of s^d Mitchel untill that time.

Jn^o Mitchel appeard in support of his attachment & produced Benjamin Biggs as his surity Notwithstanding the Case is ordered to lye over untill the next Court.

Ordered that this Court be adjourn'd untill three of the Clock in the afternoon.

SILAS HEDGES.

The Coart met according to adjournment, present as above.

Then came into Court Winey Price, & having Informed this Coart that she would Cheerfully Compromise matters with her Master Jn^o Mitchel, Beggs leave of this Court that she be Indulged the liberty of Indenting herself to her old Master

Jn^o. Mitchel for & during the Term of Eighteen months from the Twenty fifth day of may Insuing ; therefore order'd that the s'd Winey Price be indulged that Liberty for & in Consideration of all her past offences & Misdemeanours.

The Court taking unto their Consideration the Expediency of having a Courthouse Erected, ordered that a house for that purpose be erected of the following Dimentions & Conveniences, viz :

a Dimond Cornerd house of Dimentions Twenty Two by eighteen feet in the Clear ; one Story & one half high ; a floor above & below of hewd or sawn plank ; Ten Joice in the upper floor, nine or ten feet high ; in the Lower Story a Coart's Bentsh & Clark's Table : Two windows of eight lights each eight by ten Inches ; a pair of stairs & Cabbin Roof ; a plain Door & hinges of Iron ; likewise plain window Shutters, wth Iron hinges.

- (6) A Jail Twenty by sixteen feet on the outside, the Loggs of the walls to be round & Close laid the loft ; floors & partitions to be of loggs squarid to eight inches thick ; Two Rounds of Loggs above the Loft ; Cabbin Roof'd ; Doors & windows agreeable ; A Stone Chimney with Iron Grates, the doors done with nails ; Lock Sufficient ; the Loft & floor to have each a Large Summur Supporting them in the middle.

& for the purpose of having the aforementioned Buildings Completed as soon as possible agreeable to the aforesaid Dimentions, ordered that Jn^o M^cColloch, high sheriff, be ordered to put the same up at publick auction to the lowest undertaker.

Ordered that This Coart be adjourned untill Coart in Coarse

SILAS HEDGES.

The Court met according to adjournment on Monday the second day of June, 1777. Present David Sheepeerd, Silas Hedges, Zacharia Sprigg, Daniel M^cClain, James Caldwell, William Scott, Gentlemen.

The last will & Testament of Tho^s. Newbury was proven in open Court. George M^cColloch made oath well and truly to Execute the last will & Testament of Thomas Newbury, Deceas^d.; therefore order'^d. that Edward Robinson, Andrew

Boggs, James Miller & Isaac Meeks do appraise the s^d Estate of Thos Newbury dec^d.

Judgment is ordered against George M^cColloch as Guar-
nishee for Jn^o M^cSwain, six pound Remaining in his hands
attach by Joseph Ogle.

The following Militia officers took the oath of office in open
Court (Viz): David Sheepherd as Colon^l, Sam^l M^cColloch
as Major, Sam^l Mason, Jn^o Mitchel, Joseph Ogle & Sam^l Teter
as Captains, Sam^l Tumlinston, Jn^o Biggs, Derick Hoaglin,
& Tho^s Gillaland as Lieutenants, & William Sparks as Ensign
of Militia.

- (7) Jacob Lefler took the oath of Captain of Militia in open
Coart.

Ordered that the Coart be adjourn^d until Coart in Coarse.

DAVID SHEPHERD.

At a Coart held for Ohio County on Monday the 6th of
Aprile, 1778; present David Sheepherd, Silas Hedges, Zacharia
Sprigg, W^m Scott & James Caldwell, Gentlemen Justices &
Tho^s Waller.

John Williamson Came into Court and took the oath of Jus-
tice of the peace and took his seat accordingly.

Ordered that David Sheepherd, Esq^r officiate In the office
of high sheriff for this County, in the stead of Jn^o M^cColloch,
Deceas^d, agreeable to an act of assembly in that case made &
provided.

David Sheepherd came into Coart & Executed one Bond of
office of five hundred pounds & produced Soloman Hedges,
Sam^l Mason, Joseph Ogle & Andrew Fouts as sureties, who
were Excepted by the Coart. Likewise one other Bond of
three thousand pounds conditioned for his faithfully Collecting
& duly accompting for all office fees by him Rec^d et cetra, &
produced Sam^l Mason, Joseph Ogle, Soloman Hedges & an-
drew fouts as sureties, who were Likewise Excepted, Ordered
that the same be recorded.

This Coart is adjourned untill tomorrow Morning at seven
of the Clock.

SILAS HEDGES.

The Court met according to adjournment; present Silas Hedges, Jn^o Williamson, Tho^s Waller, Zacharia Sprigg & Ja^s Caldwell, Gentlemen Justices.

David Sheepherd produced a Commission from his honour Jn^o page, Esq^r, Lieu^t Governor of this state, appointing him Lieu^t of Ohio County, was Red & sworn to in open Court.

Silas Hedges produced a Commission from his honour Jn^o Page, Esq^r, Lieu^t Governor, appointing him Colonel of the Militia for this County which, was Re^d. & sworn to in open Court.

(8) Ordered that Rebekah Coons, wife of Adam Coon, Dec^d be admitted to administer upon the Estate of her husband, she complying with the law.

Rebekeh Coons then produced James M^cMechen & George M^cColloch as Surities, who were excepted accordingly. Ordered that Ebenezer Zane Sam^l M^cColloch Jacob Reager & Sam^l Mason, or any three of them being first sworn, do appraise the goods, Chattles & credits of the s^d Adam Coon, Deceas^d, & make report to the next Court

Ordered that Margret unsel, alias Margret Rentials, be admitted to administer upon the Estate of Henry Wall, Deceas^d, She Complying with the Law. Margret then produc^d W^m hawkins & Jacob Lefler as surities, who were excepted accordingly.

Ordered that Tho^s Waller, Jacob Miller, Barney Booner & Edward Geater, or any three of them, do appraise the goods and Chattles of the s^d Deceas^d, they Being first sworn, and make return to next Court

Jn^o handly produc^d a note executed by Rob^t walker, attested by Alexander Rice, whereupon Alexander Rice Came into Court to prove that he Testifi^d the s^d note, & that the same was his handwriting & that he saw Robert walker execute the Same for Value Received.

Ordered that Jacob Reager be permitted to administer upon the estate of walter Colhoon, Deceas^d, he Complying with the law. S^d Reager produc^d Sam^l Mason, Neil Galaspy, Conrad Stroup, & Jn^o Mitchel as sureties, who were excepted accordingly. Ordered that Ebenezar Law, Sam^l M^cColloch, David Sheepherd, & W^m m^cIntyre, do appraise the same, they being first sworn, & make Return to next Court.

- (9) Sam^l Mason proved an accmpt of 12.10 against the estate of Rodgers M^cBride, Deceas^d, therefore Ordered that Sam Mason be admittid to administer upon the Estate of Rodgers M^cBride he complying with the law. S^d Mason produced Jacob Reager & Conrad Stroup & Neal Gillaspys as sureties, who were accepted accordingly

Ordered that David Sheepherd, W^m. M^cLane, James M^cConnel, and James Clark, or any three of them, being first sworn, do appraise the estate of s^d m^cBride, deceas^d, and Report the same to next Court.

Ordered that Neal Gillaspys be admittid to administer the estate of Mathew Atkinson, deceas^d, he complying with the Law.

S^d Gillaspys then produced an account against s^d atkinson, whereupon s^d Gillaspys produced Jacob Rearger & Sam^l Mason as Sureties for his administering, who were accepted accordingly. Ordered that henry Sterniker, Jacob Links, James Martin & Jn^o. Williamson, they being sworn, do appraise the Estate, & make due Returns to our next Court.

Conrad Stroup produced to this Court a Commission from his honour the Governor appointing him Lieutenant of Militia for this County, which was read & sworn to in open Court.

Jerimiah Duns produc^d to this Court a Commission from his honour the Governour appointing him Ensign of Militia for this County, which being Red was sworn to in open Court

Charles Bonner produced to this Court a Commission from his honour the Governour appointing him Lieu^t. of the Militia for this County, which was red & sworn to accordingly

George M^cColloch produced the Inventory of the Estate of Tho^s. Newbury, Deceas^d; ordered that the same be Recorded.

[Upon the motion of George M^cColloch to this Court, wherein he has Exhibited Certain Instances of David Sheepherds having acted out of the Line of his office as Commanding Officer of the Militia by commissioning certain officers of Militia without the recommendation of this Court; whereupon this Court has thought that information thereof be made to his excellency the Governor, praying that he may take cognizance thereof as to him shall seem meet

Whereupon Colo. David Sheepherd came into Court and

produced sundry Commissions of Certain Gentlemen that he had Commissioned in the time of this Court's Recess, & pray^d that the Court would regulate the sd Commissions as to them shall seem meet as he acknowledges that he had no Intention to detract from the prerogative of this Court as he Conceives that the urgent necessity of the times compell^d him to act thus, and further prays that this Court would proceed to recommend suitable officers to fill up the sundry vacancies in the Militia.]¹

Jno. Hanly produc^d an acknowledgment from Jacob Crow, attested by Jno Williamson & James Caldwell, Gentlemen Justices, and others; whereupon the sd Williamson & Caldwell, Two of the subscribing witnesses, Came into Coart & attested that the sd Crow had acknowledged the same before them, Two of the subscribing Witnesses; Ordered that the same be recorded.

Colo. David Shepherd came into Court & prays the opinion of the Court as to whether he in the Case of his Commissioning Certain Militia officers of this County without the Recommendation of this Court for that purpose, was Intentionally to detract from the prerogative of this Coart in that Case or not, the Coart are of Opinion that he did not, Two members Ignoramus.¹

(10) W^m Scott enter^d Special Bail in the Case wherein Jesse Martin is plaintiff & henry Martin def^t; ordered that a didimus be issued to take the Evidence of Jn^o Isral, as well in Behalf of Jesse Martin plaintiff & henry Martin defend^t, Before Jn^o Williamson, Ja^s Caldwell, Thos^s Waller, Gentlemen Justices.

(11) W^l Williams came into Coart & entered himself Defend^t in the Case wherein Jesse Martin is plaintive, in a Case of Ejectment.

W^m williams came into Court & entered himself defend^t in the Case wherein Jesse Martin is plaintiff in Ejectment.

Henry martin enters Special Bail in the Case wherein Jesse Martin is plaintiff and W^m Williams Def^t in ejectment.

Ordered that Sam^l m^cColloch² be admitted to administer

¹ The portions above enclosed in [] are erased in the original; *Editor*.

² This was the famous Major McColloch, who, surrounded by Indians on the high hill in the rear of Wheeling, made the famous horse-back leap over into Wheeling Creek, and escaped unharmed.

upon the Estate of his father Jn^o McColloch, Deceas'^d he Complying with the Law; whereupon the s^d Sam^l produced Jn^o Mitchel, George m^cColloch, & Isaac Tayler as sureties, who were approved accordingly. Ordered that Ebenezer Zane, Jo^{ph} Vanmetre, Benjamin Hammit, & Jno Wilson, or any three of them, being first sworn, do appraise the sam & make Return to next Court.

Ordered that a suppena be Issued to bring Joseph Wilson & Mathias Ault before our next Court, to give evidence relative to an orphan Child.

Tho^r Waller produc^d an Indenture Executed by hercules Roony, & margret unsel. Binding a Certain henry unsel unto s^d Roony, adjudged by this Coart sufficient to Bind s^d henry agreeable to s^d Indenture which was attested in open Court.

John Huff Enters Special Bail in the Case wherein hercules Roony is plaintiff & Margret unsel and W^m Hawkins defendant.

Order'd that the Clerk issue summons for Thos. Peak, Letty Peak, Moses Sheepheard, Charles Bonner, Francis Sharnick, Thomas hawkins, Tho^r waller, to give evidence in the Case wherein Hercules Roony is plaintiff and Margret Unsel and W^m Hawkins defendant.

- (12) agreeable to the Requisition of Cl^r David Sheepherd this Coart ordered to recommend to his honour, the Governour, the following Gentlemen for Militia officers for this County, viz: Conrad Stroup & Isaac Micks, as Lieut^s & Jeremiah Dun, William Biggs & Hugh McConnel, as Ensigns of the Militia.

ordered that the Clerk issue Suppenas for Jn^o Caldwell, Jno Smith, to give evidence in the Case between hercules Roony & margret unsel & W^m hawkins Deft^s.

Jn^o Bodkin vs Peter Rentials, Continued.

W^m hawkins Enters special Bail in the Case wherein Jn^o Bodkin is plaintiff & Peter Rentials Defen^d.

James Bochannon produced to this Coart a Commission from his honour the Governour appointing him Capt of Militia which was red and sworn to in open Coart.

William Caldwell enters special Bail wherein the Commonwealth is plaintiff & James Caldwell Defendant, viz the Grand Jury Court next.

Ordered that the Court be adjourned untill tomorrow at eight of the Clock.

SILAS HEDGES.

Court met according to adjournment ; present Silas Hedges, Thos Waller, W^m Scott, & Zacharia Sprigg, Gentlemen Justices.

Isaac Tayler Came into Court, and on the motion of David Shipherd, high sheriff, s^t Tayler took the oath of deputy sheriff in open Court.

Whereas Jn^o McColloch, Esq., late high sheriff for this County, having Deceas^d., ordered therefore that David Sheepherd, Silas Hedges & W^m Scott be recommended to his Excellency the Governour and the honorable Council as high sheriffs in his stead ; & whereas this Court has never yet Recommended a Coroner, ordered therefore that Zachariah Sprig & Thos. Waller Esq^{rs} be Recommended as Coroners.

Ordered that the sheriff be directed to summons a Grand Jury against the next Court to be held in May next.

Ordered that W^m Scott & James McMecken Esq^{rs} be appointed to meet Certain Gentlemen Commissioners from the County of Yohogany, for the settling the County line between this & the Counties of Yohogania & the County of Monongahala agreeable to act of Assembly, Return to our next Court.

(13) ordered that several Magistrates in this County do take the list of tithables agreeable to the following precincts. Viz :

That James Caldwell, Esq., take the list of all the Tithables on the waters of Wheeling Creek ; & Zachariah Sprigg, Esq., take those on the waters of short Creek ; Silas hedge, Esq^r, all those on the waters of Buffalo Below Ezekiel Dewits ; & Tho^s waller, Esq., all the Tithables on the South side of Williamsons fork of Buffalo Creek & above Ezekeil Dewits ; & Jn^o Williamson, Esq^r., all those on the north side of Buffalo above Andersons mill to the County line, south of and along the Road from Andersons mill past Isaack Taylors leading to Robt Cunninghams ; & William Scott, Esq., all those remaining in the County.

Whereas Jn^o McColloch & D^t McClain, Esq^{rs}., are deceased, & Thos poak not within the limits of this county & Abraham . . . declines to qualify, Ordered that the following Gentlemen be Recommended to his excellency the Governour as proper persons to be added to the Commission of the peace in & for the County, viz : Edward Robinson, George McColloch, James Miller, Ebenezer Zane, David McClure, Sam^l McColloch, Jos

Boggs, Jn^o Dodridge, Charles, Wells, Ja^s Gillaspv, Jun^r., & whereas, in the former Commission of the peace for this County, there must have been a Mistake in the Recommendation placing that of Silas prior to that of Soloman Hedges, s^d Soloman having formerly acted as Jude in the Coart of hamshire, this Court therefore would pray that Soloman aforesaid be inserted the first in the List in the new Commission.

Ordered that Jn^o Wrights, Jno Tilton, David English, Eliazer williamson, & Thos Williamson, be summoned to next Coart to be qualifed as Constables, to serve the insuing year.

Dan^t Glallaspy ver Conrad Wheat, Continued

William hawkins ver Thos oge, Continued.

Jn^o Caldwell ver Catherine Neel, Continued.

Isaac Tayler ver William Caldwell, Continued.

Charles Stephenson ver Rob't. Lemmon, Continued.

(14) W^m Caldwell ver Isaac Tayler, dismissed, not legally served.

Rob^t M^ckin ver James Clark, Continued.

Isaac Tayler ver Nathan Templeton, C. O. in Ejectment.

Jn^o hanly ver Rod. Walker, S B, Continued.

Joseph Wells ver Jn^o Carpenter, Continued.

W^m Scott ver William Caldwell, Continued.

Ja^s Gillaspv ver W^m Caldwell. C. O.

Thos. Waller Esq. produced to this Court a recognisance against Murty Hanly & W^m hawkins & James Patton as sureties, Wherein the Commonwealth is plaintiff, & the said Handly not appearing though solomly Called, nor either of the sureties, it is Considered by the Court that a Common order be Issued against s^d Murty handly, W^m Hawkins & James Patton, or either of them, to answer at our next Coart to the above Charge

Tho^s Waller produc^d to this Court a Recognisance, wherein the Commonwealth is plaintiff & Isaac Foglor Defen^d & no evidence appearing, ordered that the s^d Case be dissmised,

Ordered that this Court be adjourn^d until Coart in Coarse.

SILAS HEDGES.

At a Court Continued & held for Ohio County ; present Silas Hedges, Zachariah Sprigg, Jn^o Williamson, & David Sheapherd, Gentlemen,

A Commission of the peace directed to David Shepherd, Solomon Hedges, Silas Hedges, David Rodgers, W^m Scott, James McMechen, James Caldwell, Jn^r Williamson, Zachariah Sprigg, Thomas waller, Edward Robinson, George McColloch, James Miller, Ebenezer Zane, David McClure, Sam^l McColloch, Jn^o Boggs, Jn^o Dodridge, Charles Wells & James Gillaspy, Jun^r., w^h Being Red the following Gentlemen named therein took the oath of Justices of the peace & took their seats accordingly, viz: Silas Hedges, Zachariah Sprigg, James Gillaspy, Jun^r., Jn^o Williamson, Jn^o Doldridge, Jno. Boggs, & George McColloch, Gentlemen.

A Commission from his Excellency the Governour, to David Shepherd appointing him High Sheriff of the County of Ohio was red & swore to in open Court, whereupon s^d Shepherd produs^d Resin virgin, Joseph ogle, & Andrew Fouts, sureties, & entered into Bond.

- (15) Zacharia Sprigg, Gentlemen, took the oath of Coroner for this County, a Commission from his Excellency the Governour appointing him to that office being first red.

Letters of administration are granted to Margret alhauce on the Estate of George alhauce, Deceas^d, she Complying with the Law ; whereupon the s^d Margret produc^d Ezekiel Dewit & Thomas Waller as sureties.

Ordered that Barny Bonner, Alexander Douglas, Edward Geater, & Jacob Lifter, or any three of them, they being first sworn, do appraise the afores^d Estate & make Report to next Court.

Administration is granted to Susannah Burn & James Car upon the Estate of Jonothan Burnn, Deceas^d they Complying with the Law ; whereupon the s^d Susannah & James produs^d Frederick Lamb & John Doldridge as Sureties, & entered in to Bond and oath accordingly

Ordered that Tho^s Clark, Arthor McConnel, Andrew Scott & David Reynolds, or any three of them, they being first sworn, do appraise the good Chattle & Credits of s^d Deceas^d & make report to next Court.

Ordered that Allen Steward be Bound unto James Gillaspy agreeable to his acknowledgment & requisition before W^m Scott or any other Justice of the peace.

Resin Virgin produs^d to this Court a Commission from his Excellency the governour appointing him Captain of the Militia which was red & swore to accordingly.

Isaac Meeks produced to this Court a commission from his Excellency the governour apointing him a Lieutenant of the Militia which was Red & sworn to accordingly.

John Boggs produced to this Court a commission from his Excellency the governour apointing him Lieutenant of Militia which was Red & sworn to accordingly.

- (16) Andrew Foutts produced to this Court a Commission from his Excellency the governour apointing him an Ensign of Militia which was Red & sworn to accordingly

ordered that Isaac Phillips & W^m List be recommended to his Excellency the governour as proper persons to serve as officers in the Militia, Phillips as Lieutenant and List as Ensign.

Jona Simmons took the oath of Deputy sheriff in open Court.

William Hawkins enters himself special for Peter Hildibrand at the suit of Jn^r Tilton

Bargain & sail from Alexander Douglas to Jesse Hollingsworth, for six hundred acres of Land, & ordered to be Recorded.

ordered that the Court be adjourned till tomorrow at eight of the Clock at the house of Andrew Ramsay

SILAS HEDGES.

The Court met according to adjournment on the 2^d day of June, 1778. present Jn^r Williamson, Zachariah Sprigg, Jn^r Boggs, James Gillaspy, George M^cColloch & Silas Hedges, Gentlemen Justices.

Ordered that James Henderson, an orphan Boy, be Bound unto Joseph ogle, to Learn the Shoemakers Trade & Mystery, Before any Justice of this County, aged ten years, Feb.^{ry}, 1778.

Solomon Hedges, Edward Robinson, & James M^cMechen, Gentlemen named in the Commission of the peace for this County, came into Court & took the oaths of Justice of the peace accordingly.

ordered that Mary ogle, wife of Jacob ogle, deceas^d, killed in the service of the United States, a Militia soldier of this

County, be allowed the sum of twenty five pounds to enable her to support herself & six small Children for the ensuing year, & to draw on the Treasurer for the same.

Ordered that Sarah Clark, wife of Hezekiah Clark, a Regular enlisted soldier in the thirteenth Virginia Regiment, be allowed for her own support & Two small Children for one year, the sum of fifteen pounds, & that a draft for the purpose issue to the treasurer.

- (17) Zacharia Sprigg, with George McColloch Surety, Came in to Court and executed a Bond of £500 for the due Execution of the office of Coroner for the County of ohio.

Ordered that the sheriff apply to M^r Richard Yates for permission to make use of the district ¹ Jail to Imprison Delinquents during these difficult times of danger & want of Jail at the Courthouse seat for this County, upon the most Reasonable Terms possible.

Ordered that David Sheepherd, sheriff for this County, advertise to the Lowest undertaker the Building of the publick Buildings for this County, agreeable to the Dimentions therein Contained.

James Bruce produced to this Court a Commission from his Excellency the Governour appointing him Ensign of the Militia, which was red and sworn to accordingly.

Upon the motion of Benjamin Biggs ordered that his ear mark an upper half-peny marck & slit in the right & Brand B B be recorded upon the near thigh.

Upon the motion of Nicholas Rodgers ordered that his mark a Swaller fork in the left ear & a crop in the right be recorded

Upon the motion of George McColloch, ordered that his mark a Crop off the left ear & slit in the same & under half peny in the right be Recorded.

Upon the motion of Zachariah Sprigg, order that his mark a Crop in each ear & hole in the right ear be Recorded.

Upon the motion of Isaac Tayler, orderd that his mark, a Crop in the left Ear be Recorded.

Upon the motion of Joseph ogle, ord that his mark a Crop in the left ear and under bit in the same be Recorded.

¹ This was the jail erected for the District of West Augusta, on the late Gabby farm, just west of Washington.

Upon the motion of Tho^s waller, orderd that his mark a Crop & Slitt in each ear be Recorded.

Upon motion of James Gillaspy, Jun^r, orderd that his ear mark a Crop & Slitt in the near ear & two slits in the off ear be Recorded.

Jn^o warford mov'd that his ear mark a Crop in the left ear & under Bitt each be Recorded

(18) Upon the motion of Resin virgin orderd that his ear mark a swallow fork in the right ear be Recorded.

Upon the motion of Jn^o Boggs order'd that his ear mark a crop in each ear & hole in the right ear & Brand IB on the sholder & Buttock be Recorded.

Upon the motion of Edward Robinson, orderd that his ear mark an upper half-peny in the right ear & under half peny in the left be Recorded ; also the Brand E on the sholder & R on the Buttock boath on the left side

Upon the motion of Jacob Newland, orderd that his mark a Crop in the left ear & hole in the right be Recorded

Upon the motion of Charles Hedges orderd that his ear mark an under half crop in the right & under bit in the same & under bit in the left ear be recorded

Upon the motion of Andrew Fouts orderd that his ear mark a Crop in the right ear & two under cross slits in the left ear be recorded

Upon the motion of Jno. Harris, orderd that his mark a crop and under slipe in each ear be Recorded

Upon the motion of James Andrews, orderd that his ear mark a Crop in the right ear & under bit out of each ear be Recorded.

Upon the motion of Derick hoaglin, orderd that his ear mark a swallow fork in the lift ear & under half peny in the right be recorded.

Upon the motion of James Newal, orderd that his ear mark a Crop off the right ear & under bit out of the left be Recorded

Upon the motion of Ebenezer Zane, orderd that his mark a Crop and .slitt in the near ear & slitt in the off ear be Recorded

Upon the motion of Isaac Meeks, orderd that his mark a Crop off the right ear & slitt in each ear be Recorded

- (19) upon the motion of David Shepherd, ordered that his mark a Crop in the right & swallow fork in the left be Recorded.

A Recognisance against Sam^l Mason, for disposing of & exchanging some of the Continental Stores at Fort Henry, Exhibited by C^l David Shepherd; whereupon the Defendant came in to Court & acknowledgd the Charge in part; whereupon this Court have Considered that Sam^l Mason afores^d be fined five pounds & Return into the hands of Co^{lo} Shepherd an equally good gun, or the value thereof; valued by Raesin virgin & Joseph hoge, sworn for that purpose, valued at seventeen pounds; furthermore it appears to this Court that Sam^l Mason afores^d had exchanged his own property for the stores aforesd with a Certain V. Doulton, D. Q. master in the Continental service.

The Commonwealth v. Murty Hanly for Dissaffection to the State, the breach of a penal [statute] for the punishment of Certain offences; the Defend^t being Bound in Recognisance to this Court, the def^dt came in to Court & pleads not guilty; then came a Jury, viz: Resin Virgin, Jacob Newland, Benjamin Biggs, Charles Hedges, Isaac Tayler, Joseph ogle, Derick Hoaglin, W^m Biggs, Andrew Fouts, Oliver Gorrel, Jn^o warford & Jn^o Harris; who Bring a verdict for the Commonwealth. Mauty Hanly, guilty of speaking of offensive words against the Commonwealth, to suffer imprisonment from now to the first day of September next, then to pay a fine of ten pounds & to be discharged then upon taking the oath of fidelity or giving Security for his further Behavior.

W^m Hawkins v. Edward Mills, in attachment, the sheriff returns no goods found; orderd to be dismissed with Costs to plaintiff.

- (20) Upon the Motion of C^l David Shepherd, ordered that Requisition be made to the worshipfull Justices of Yohogania County, to Call upon the Commissioners for adjusting the Boundary line Between the Coutny^s of Yohogania & Ohio as soon as possible & report their proceedings, so the Militia in the disputed Territory may forthwith be Called upon if Requir'd.

Absolam Sparks ver Jn^o Carpenter, A Sum.

Joseph Wells ver Jn^o Carpenter, C. o, in Eject.

W^m Scott ver William Caldwell, Continued.

Jn^o Tilton v Jn^o Bodkin, alias

James M^cMechen v Alexander Douglas ; the Defendt Came in to Coart & acknowledged the debt in the plaintiffs Declaration alledg'^d. Wherefore, the Court have Consider^d that the s^d douglass pay the sum of Twenty pounds fifteen shillings Pen's money, of equal value to sixteen pounds twelve shillings Virginia money & Costs

George Corn ver Jona Simmons, Continued

Rob't walker v. W^m Hawkins, C o

———— v. Jn^o Hanly, alias

David M^cClure v Jeremiah Dunn, Dismiss'd

James Caldwell v Sam^l Ma^on, Continued, the s^d Mason entering himself Defendant.

Orderd that Isaac Tayler be allowd for his service of going express to & Returning from Williamsbourgh, the sum of Twenty five pounds. Likewise 12 shillings he paid upon the Cards Consignd for this County, to be paid by the party that may draw the same agreeable to Certificate.

Ordered that Solomon Hedges & Jn^o Williamson, Gentlemen, distribute the publick cards Consignd to this County upon proper & sufficient Certificates to them produc^d.

Orderd that the sheriff Collect a publick Tax of four & Twenty shillings Poll upon all Tithables within this County, & pay the same to the Different orders from this Court, Excepting the proportion Levy to the treasurer.

Isaac Tayler v Nathan Templeton, S. B.

Andrew Robinson v Conrad Wheat, C o

James Gillaspy v W^m Caldwell & Jane, in Slander ; the Defend william failing to appear thoug Solomly Call^d by defend. t and on order from this Court, on Motion of the plaintiff, ordered that the same be forthwith try^d. Whereupon then Came a Jury as above, & bring a verdict for the plaintiff of three pounds & Costs, & Damage 1 peney.

(21) Sprig v. Jeremia Dunn C. O. against William Hawkins for Rescue.

Dan^l Gillaspy v Conrad Wheat, Continued.

W^m Hawkins v Conrad Wheat, Continued.

W^m Hawkins v Tho^s ogle, Continued.

Isaac Tayler v William Caldwell, C. O

Charles Stephenson v Rob^t Lemmon, Dismissed.

Jn^o Bodkin v Peter Rentals, Cont.

Hercules Roany v Margret unsel, }
v William Hawkins, } Cont.

Jn^o Hanly v Rob^t Walker, Continued.

Jesse Martin ve Henry Martin, Continued.

ver W^m William, Continued.

ver Elisabeth Cunningham, the same

David Shepherd protests against the sufficiency of the Jail of this County.

James Gillaspy ver James Caldwell, C. O.

Ordered that David Martin, David Cox, John Ferguson, Henry Martin, be appointed Constables to serve the Ensuing year, & that they be summonsd to swair into said office before the nearest Magistrate Respectively.

Isaac Tayler v william Caldwell, in Case, came the parties, & the Defendant pleads the general Issue, whereupon there Came a Jury, viz: Resin virgin, Jacob Newel, Benjamin Biggs, Charles Hedges, John Harris, John Carpenter, Derrick Hoaglin, W^m Biggs, Andrew Fouts, oliver Gorril, Joseph ogle, Jn^o warford, who being sworn & impanel^d find for the plaintiff the sum of 1 shilling damage. It is considered by the Court that this Judgment be discharg^d by payment of one hundred and sixty pounds Current money of the State & Costs in that Behalf Expended.

(22) William Caldwell Enters special Bail for Nathan Templeton at the suit of Isaac Tayler

Ordered that it be a Rule in future in this Court to hold Courts for the trial of Jury Cases only in the months of Martch, May, august, and November.

Isaac Tayler took the oath of Deputy Clerk for this County

Ordered that this Court be adjourned till Court in Coars.

SOLOMON HEDGES.

At a Coart Continued and held by adjournment for Ohio

County July the 6th 1778; Press'nt Solomon Hedges, Edward Robinson, Silas Hedges, George McColloch, Esq^r. Gentlemen.

Jacob Wolf produced to this Court a comission from his Excellency appointing him Lieutenant of the Militia of this County, which was Read & sworn to accordingly.

W^m. Leet & David English produc'd to this Court Commissions from his Excellency appointing them Ensigns of Melitia, which was Read & sworn to Accordingly.

James Caldwell mentioned in the didimus came into Court and took the Oath of a Justice of the Peace & took his Seat.

David English being summoned as Constable to serve in that office, and took the oath agreeable thereto in open Court.

George McColloch Enters special bail for W^m Hakins in a Case wherein James Smith is plaintiff & the s^d Hakins is Defendant.

At the motion of James Smith it is ordered that a Didimus to Thomas Freeman, W^m Goe, & Joshue Wright, or any two of them, to take the Evidence of Johnston Campbell & Hugh Brison, in behalf of the Defendant & plaintiff, as also Benj^d. Parkison &c.

John Carpenter enters himself Defendant in a Case wherein Joseph Wells is plaintiff in Ejectment, and Thomas Nichols Entrs himself Defendant at the suit of Rizon Virgin on an Ejectment.

- (23) Jacob Wolf Enters himself Defendant at the suit of James McBride in Ejectment. Chrisly Wolf Enters himself Defendant in the suit wherein James M^cbride is plaintiff in Ejectmont.

ordered that this Court be adjourned to Court in Course.

SOLOMON HEDGES.

The Court met according to adjournment, August the 3^d, 1778. Present Solomon Hedges, Silas Hedges, James Caldwell & James Gillespy, Gentlemen.

David McClure, Charles Wells, James Miller & W^m Scott, being mentioned on the didimus, came into Court & took the oath of Justices of the Peace, & took their seats accordingly

David McClure produced to this Court a commission from his Excellency appointing him Lieutenant Colonel of Melitia for this County, which was red & sworn to accordingly

Ordered that a didimus Issue to take evidence of Cap^t Bohanar in behalf of Rob Walker against W^m Hakins & that David McClure & W^m Scott Do take this examination

Eloner Cox & Israel Cox Produced to this [Court] the Last will & testament of Gabrial Cox, Deceased, & the same was Proved in open Court & Ordered to be recorded.

Ordered that Jn^o Huff, Benj^a Biggs, Jn^o Biggs & Derick Hogland, Do Appraise the Estate of gabrill Cox, Deceasd, and make report to next Court.

Whereupon Eleoner Cox produced to this Court Thomas McGuire & Francis McGuire as Securesities & entrd into bond & oath accordingly

Ordered that Eloner Cox & Israel Cox be admitted to administer on the afforsd Estate.

Ordered that Jemima Buckey be admitted to administer on the Estate of her husband she complying with the Law Whereupon the Last Will & Testament of s^d Buckey was Produced in Court & Provd & ordered to be recorded.

Whereupon s^d Eloner Product Levi Mills as a surety who was approved of accordingly & entered into bond

(24) Ordered that Samuel Mccolloch, Jn^o Mitchel, Joseph Vanmetter & Jn^o Willson, they being first sworn, do aprais the s^d Estate & make report to next Court.

Andrew moore enters himself Defendant in a case wherein W^m Haskins is plaintiff in Ejectment.

Robert Heger enters special bail for Andrew Moore in a case wherein W^m Hawkins* is plaintiff & sd moore Defendnt, in an action of Trespass.

W^m Scott enters special bail for James Galaspy at the suit of W^m Caldwell, in a case of Tresspass & Detener.

John Tilton came into Court & took the oath of a Constable
Thomas Mcguire enters himself special Bail for Jn^o Carpenter at the suit of Nicholas Rogers, in a case of Trover & conversion

Joseph Hedges producd to this Court a Certificate from under the hand of Silas Hedges, Gent., of his taking up two stray Heifers with a Description of them, they being apraisd at £3 Each. Ordered that they be Advertised by the Clerk agreeable to Law & recorded.

Silas Hedges producd in Court a Certificate Certifid by Solo

mon Hedges, Gen^l, of his being the taker up of a stray steer apraised to £8. Ordered that the same be advertisd according to Law & recorded.

Ordered that Catherine Smith, wife of Samuel Smith, a regular Enlisted soldier in the 13th Virginia regiment, be allowed the sum of seven pounds Ten shillings to support herself and Three small Children for the Ensuing six months, and that a draught Issue to the Treasurer for that purpose.

Absolum Sparks vir Jn^o Carpenter, P S. Then cam the parties & the Defendant pleads the general Issue & the same is ordered to lye over till tomorrow until the defendant has the benefit of his evidence.

Ordered that this Court be adjourned until tomorrow morning at six o'clock.

SOLOMON HEDGES.

Court met according to adjournment, August 4th 1778, Present, Solomon Hedges, Silas Hedges, James Caldwell, James Gallespy, & James Miller.

Isaac Phillips producd to this Court a commission from his Excelency appointing him Second Lieutenant of Militia, which was red and sworn to accordingly

Upon the motion of Francis M^eguire, ordered that his ear mark two swallow forks & an under bit in the Left ear be recorded.

Upon the motion of W^m Harvey, it is orderd that his ear mark a crop in the Left ear a slit in the right and a half Crop be recorded.

(25) Upon the motion of Luke Seermehok (?), ordered that his ear mark a swallow fork in the right ear & a whole in the Left be recorded.

upon the motion of James Moore, it is ordered that his ear mark a slit in the Left ear & an uper bit out of the right be recorded.

Upon the motion of John Carpenter, it is ordered that his ear mark a swallow fork in the off ear two nicks, one on each side of the neer ear, and Brand I. C. on the neer shoulder be recorded.

Upon the motion of Andrew Ramsey it is orderd that his

ear mark a crop of the right ear and an under bitt under the same & a swallow fork in the Left be recorded

upon the motion of Jonas Simons, it is ordered that his ear mark a Crop of the neer ear & an under bitt under the off Do be recorded.

Ordered that David English be recommended a Captain to his Excellency the governer, And Luke Enlow, a Lieutenant & Thomas Ryeres as Ensign.

David Mcclure, Gent, absent.

An attachment David McClure on the goods & chattles of Alexander Dooglas, the sheriff returns that by virtue of sd attachment he hath attachd the following effects: two potts, one frying pan, 2 wheels, 1 bed stead, 1 Churn, 1 Barrel, Twelve sheep, four cows & calves, & one hefer, in the hands of Samuel Mason, Thomas Peak & W^m Hawkins, and the said Alexander Douglas being solemnly called does not appear, Whereupon the said mason produces Hugh Siddwel an evidence, who being sworn saith he saw Samuel Mason Purchase the above articles of sd Dooglas, & the Coart is of opinion that the sale is good, & Thomas Peak & Samuel mason was sworn as garnishee, & nothing apers in their hands Except a side of Lether, in the hand of Mason, when taned.

Upon the motion of Samuel white, orderd that his ear mark a Under bitt out of each ear & a Slitt in the right be recorded.

On the motion of Jn^o M^cCormick, orderd that his ear mark a Crop of the Left ear a Slit & under bitt in the right be recorded.

Upon the motion of Henry Levens ordered that his mark a crop and Slitt in the right ear & a hole & half crop in the Left be recorded.

On motion of Isaac Phillips, it is ordered that his mark a crop of the Left ear & a slitt & upper bitt in the right be recorded.

On the motion of Jn^o Biggs, ordered that his mark a swallow fork in the Left & a hole in the right ear, Brand I B on the neer shoulder, be recorded.

David English product in this Court a commission from his Excellency apointing him a captain of the Melitia which was red & sworn to accordingly, recorded.

- (26) Luke Enlow produced a commission from his Excellency appointing him a Lieutenant of Melitia which was red & sworn to accordingly

The issue Absolum Sparks against John Carpenter, in case, by petition & summons, is ordered for a hearing. Then came the parties and Pleads upon the Issue joined as in Debt for one Deer skin, & the Court gives a Judgment for the plaintiff to have his account of £1.. 10.. & Costs in this behalf Expended.

Henry Nelson an Evidence, 2 days attendance allowed.

Jesse Martin Trespass and Detiune.
vs Dismissd at Pffs Request

Henry Martin.

It appearing to the Court Rowland Martin an Evidence be allowed two days attendance — ordered that he be allowed for the same

| | | |
|--------------|---|-----------------------------------|
| Jesse Martin | { | Ejectment. |
| vs | | The Deft appears & enters himself |
| Harry Martin | | Defendant in the Cause |

Jesse Martin Ejectment.
vs The sheriff returns that he served this

—— Dement ejectment on Dement, the Defendant; whereupon Rawly Martin, a Serjeant in Capt Scotts Company in the service of the United States, informs the Court on oath that he is materialy concerned in the ejectment, and if the same is tried when he may be ordered to some other state and consequent be not able to attend, the Court in pursuance of the Orders of the Honble the Continental Congress direct that no further proceedings be had thereon till the sd Martin is discharged.

James Gillespy Gent Absent.

James Gillespy Gent

v In Case

William Caldwell

& Jane Caldwell

Then came the Ptff and the Defendant Jane Caldwell personally appeared in Court and prays that this Cause may be enquired of by the Country to which the Plff having signified and both parties being willing to have the same tried without the for-

- (27)

Nicholas Maulson Trepass & Detinue,
v Then came the parties and jointly prayed
John Donavan that the Differences between them may
be enquired of by the Country without the form of a Declaration. Ordered that the Sheriff is commanded that he cause a
jury to come before the Court immediately to enquire of the
same; Whereupon David English, W^m Hawkins, W^m Caldwell,
James Asby, Isaac Philips, Sam^l M^eBride, John Warford, Isaac
Week, Rawley Martin, Harvey Martin, Samuel Osburn &
W^m Williamson, who being duly elected and sworn do say on
their oaths that there is nothing for the plaintiff by his suit.

Robt Walker vr. W^m Hawkins, in Trepass & Detinue Continued.

W^m Hawkins enters special bail for Joseph Arnold at the suit of Nicholas Maulson.

(28) Ordered that a didimus issue to take the Deposition of Rawley Martin before Zacharia Sprigg & Silas Hedge, at the suit of Jesse Martin and Harry Martin in Ejectment, and on behalf of W^m Williams likewise, he being a Soldier & of Consequence must be absent.

Ordered that the sheriff Collect Twenty shillings & six pence off of every Tithable within this County as a County Levy & the sum of Three shillings & six Pence as a proportion Levy, & Double that sum from all Who refuse to take the Oath of Allegiance, That is above sixteen years of age.

Orderd that David M^cclure's attachment against Dooglas be continued over to next Coart.

Ordered that the balance due on a bond attached in the hands of Samuel Mason after deducting £5 of discount, be paid to David M^cClure on account of his attachment.

John Bodkins v. Peter Renchals, in Defamation, ordered that the cause be Dismist for non Prosecution.

Joseph Wells v. Jn^o Carpenter, Ejectment, Dismist.

George Corn v John Seamons, Defraud, Continued to next Court at the Cost of the Plaintiff.

Joseph Tumbleston v Sam^l Mason, in acc^t, the plantift not appearing tho solomly Called to Prosecut, Ordered that the s^d suit be Dismist.

Upon the Evidence of David Shepherd Exhibited to this court upon oath of Jn^o Huff's assaulting this court, order'd that the s^d Huff be find the sum of Six Dollors & remain in Custody of the sheriff Until paid, & then Dismist wth Costs.

Ordered that this Court be adjourned untill Coart in Course.

SOLOMON HEDGES.

(28) At a Coart continued and held for Ohio County the 7th day of September 1778

Present, Silas Hedges, David M^cClure, James Gillespy, John Boggs, Ed^w. Robinson, John Williamson, Gentlemen Justices.

Mr James M^cMechen, Clerk of this Court, being down the Country, the Court proceeded to appoint James Berwick Clerk for the present Court who took the oath accordingly.

Absent David M^cClure, Gent.

David M^cClure Gent produced two Letters signed James M^cMecken, relative to his being appointed Clerk of this County. Ordered that the same be rejected and the said Letters filed among the records of this Court.

David M^cClure, Gent, Present

Isaac Taylor entered into Bond and Security to finish the Goal and Court house for this county the court house by the 1st March next, and the Prison by the 1st May next; Ordered that the sheriff do advance Mr Taylor the sum of fifty pounds and take Mr Taylors receipt for the same.

Isaac Taylor acknoweldged a Bill of Sale to George Corrothers for 200 acres of Land, which is ordered to be recorded.

Report of the Commissioners of the County Line between this County & County of Yohogania returned, & confirmed by the Court and ordered to be recorded.

Two Depositions of Raleigh Martin, a Soldier in the Continental service, ordered to be filed in the office

(29) Hugh Gillilan

v Jeremiah Dunn, S. B.

Annaniah Davis

Zephaniah Dunn.

Jeremiah Dunn enters himself Defendant in a Action of Ejectment at the suit of David M^cClure.

Ordered that the Court be adjourned to the Court in Course

SILAS HEDGES

Summons to Sept^m 1778.

Hawkins v Kintelo, continued

Martin v Tuel, contnd

Flavin v Mason, contd

Appearance &c to Sept^m 1778.

Huff v Berwick, contd

Berwick v Huff, contd

Same v Same, contd

Tomlinson v Mason, contd

McClure v Dunn (Ejectment), contd

Virgin v Brounlee, contd.

Taylor v Caldwell, contd

Caldwell v Taylor, contd

Wells v Carpenter, contd Ejectm.

Hawkins v Kentiello, contd do

Walker v Handley, Plu Caps

Tilton v Bodkins, Al Caps

(30) Martin v Leet, Alias Capias

Drennin v Nemons, Al Caps

Markland v McBride, Al Caps

At a Court held for Ohio County on Monday, November 2^d, 1778; Present Solomon Hedge, Silas Hedge, W^m Scott, Geo. M^cColloch, James Caldwell, Charles Wall.

Philip Pendleton & Geo. Brent, Gent^m took the oath of Attorney at Law and is admitted to practice as such in this Court.

Philip Pendleton Gent is appointed as a Deputy Commonwealth Atty for this County till some person is appointed by the Governor.

On the motion of John Moore setting forth his great age & Infirmitis, It is Ord that he be for the future Exempted from the Payment of levy in this County James M^cMachen the Clerk having removed himself out of this State and neglected to do his duty as such. It is ordered that a Complaint be Entered in the General Court against him for the same.

Admon of the Estate of Thomas Glenn, dec^d, is granted to his Widow Elizabeth Glenn, she having Complied with the Law

Ord that John Mitchell, Ebenezer Zanes, Levy Mills, Jos. Vanmeter, or any 3, app the Estate.

The Court having ordered a Complt to be lodged against James M^cMechan as Clerk of this county & he being out of this State the Court doth appoint David M^cClure Clerk until the same shall be determined, & thereupon the s^d McClure took the Oath of a Clerk.

Grandjury for this County being called, James Clemons was sworn as foreman, and then Jacob Newland, Jacob Peat, James Moore, James Andrew, Samuel Mason, Jesse Dement, annanah Davis, Ezekiel Biggs, Benjamin Biggs, Nicholas Rogders, James Newell, Thomas Gilliland, John Huff, John Mitchell, Jacob Drenning, & Ebenezer Martin was sworn

(31) David Williamson took the Oath of Captain of the Militia of the County which he produced in Court & O Certified

Samuel Williamson prod an Ensign Com of the Militia, took the Oath & Ordered to be Certified present, James Gillespie, Gent.

Upon examining Isaac Ellis, John Downing, W^m Williams and John Baker, who was suspected of the murder of James Caldwell & Sam^l Kennady, are of the opinion that they are not Guilty, & that they be discharged.

Ord that Jacob Lefler, Edward Gaither, James Brownlee & Sam^l Mason, or any 3, app the Est of Geo Allhaunts, dec^d, & report the app, the former appraiser failing to return the appraisement.

On the Motion of Jacob Lefler seting forth that he was secy for Margt Unsel (who is since married to Peter Kintelo) for her admon of the Estate of Henry Wall, & that it app that he is Likely to suffer, It is ordered that the s^d Margt & peter be summoned to appear at the next [Court] to deliver her up the Est or give him Counter Security.

The Grandjury having made several presentments, It is ord that the Several debts be Sum^d.

Orderd that the Court be adjd until tomorow morning 8 oclock
SILAS HEDGE.

At a Court Continued and held for Ohio County November 3, 1778, Prest Solomon Hedge, Sila Hedge, James Caldwell, W^m Scott, James Galespie, Geo M^cColloch.

Ord that William Price, a bastard child of Sarah Price, of the age of two years, be bound according to Law to John Waits on his motion.

Present Edward Robertson.

Ordered that the sheriff of this County pay Richard Yeats Six pounds it being this County's proportion of the district Goal out of the Money by him collected of the Tithables in this County.

Ordered that the sheriff pay Abraham Vanmetre Twenty pounds for the Lands which the County took to build a Court house and prison on, out of the Money by him collected of the Tithables in this County.

(32) Admons of the Estate of Frances Duke, dec^d, is granted to Col^o David Shepherd, he having Complied with the Law.

Ord that Jacob Newland, Charles Headges, John Mitchell, & Joseph Vanmeter, or any 3, app the Estate.

Galespie v Wheat, Con^d

Mitchell v Hamell, dis^d by plt

Hawkins v Ogle, con^d

v Wheat, con^d

Caldwell v Neal, discon^d

Delong v Flanagan, Cond.

Stephanson v Lemenon, descd.

M^cQuire v Clark, Cond

Taylor v Templeton, a dedim to take the Dep^s of Wit^s in the State of Pennsylvania.

Handley v Walker, con^d.

Raaney v Unsel & Hawkins,

Handley v Walker, cond.

Martin v Williams, Cond.

Cunningham, Cond.

Scott v Caldwell, Sp. Imp. B.

Taylor v Caldwell,

Tilton v Bodkin, dis^d, no Inhab.

v Hillibrand, Cond.

Com v Lemons, Cond.

Walker v Hawkins & Handl, Cond

Caldwell vs Spindall, Saml Mason Enters himself def & Confesses the Lease Entry & ouster pleads N. G. A Demidmus to take the Dep^s of Wits P.

Crow v Handley, Co.

Douglas v McGuire, dis^d no app.

Smith v Hawkins, Cond.

Mcbride v Spindall ; Jacob & Chrisley Wolf enter themselves deft, Confess the Lease Entry & ouster plead N. G. joined. P.

Virgin v Nichols, cond.

Maulson v Arnold, cond.

Gilliland v Dunner, agreed.

Caldwell v Zane, agreed.

English v Clark, Disd.

Martin v Martin, Ejec. Cond.

Galespie v Templeton, agd.

Hawkins v Moore, agd.

(33) Rodgers v Carpenter, Cond.

Jesse Martin v R. Martin, Cond.

McClure v Douglas, dis by plt.

McClure v Dunn, Ct.

Caldwell v Galespie, Emp. P.

Huff v Berwick, Cond.

Berwick v Huff, Cond.

Huff, Cond.

Drenen v Neinans, agd.

Hawkins v Kintole, Cond.

Wells v Carpenter, Cond.

Hawkins v Kintole, Cond.

Tomlinson v Mason, Cond.
 Glenn v Douglas, discond.
 Garrison v Shepherd, agd.
 Martin v Tuell, agd
 Martin v Leek, cond.
 Hawkins v Mason, agd.
 Hawkens v Kentoll, Cond.
 Markland v M^cbride, NG, with leave Nom^d B
 Virgin v Brownlee, Cond.
 Caldwell v Taylor, Sp. Imp. P.
 Taylor v Caldwell, Sp. Imp. B.
 Kintolle & wife v Wall, Cond.
 Clemans v Lane } John Waits, Spl in both suits & agreed
 Lane } deft paying Costs
 Drenin v Jolly, Ind.
 Gillyard v Hawkins, Samuel Mason, Sp. Imp. B.
 Caldwell v M^cMechen, dismd, no Inhab, Taylor, C.

Present Zachariah Sprigg, Gent.

The Last will & test of Samuel Wheat, dec'd, was proved by Zachariah Sprigg & Geo M^cColloch, two of the wit, & OR, & at the Motion of Jemima Wheat & Isaac Meek, the Est therein named Cert is granted them for Obtaining a probate, they having Compd with the Law : Ord that James Miller, Derick Hogland, Joseph Hedges & And^w Ramsey, or any 3, app

(34) the Est.

Then the Court proceeded to Lay the County Levy :

| | |
|---|----------|
| To John Biggs, by account £21 | 21- 0-0 |
| To William Scott, by account, £ | 8- 0-0 |
| To Philip Pendleton, Gent, as deputy Commonwealth atty £50- | |
| To Isaac Tayler, by account, | 8 |
| To David Shepherd, Gent, for extra services for 3 months 310 tob. | |
| To also 230 tob. for extra services, for 12 months, | 9-12- |
| To James McMechin, by acc for extra services & for at- tending the running of the county line, | 11- 2-6 |
| To the sheriff for collection, | 12-15-0 |
| To a deposition in the sheriff's hands, | 81-18-0 |
| By 352 tithables a 11 s. 6 p. each | 202- 8-0 |

Ord that the sheriff Collect of every tithable person in the County 11/6, it being the County Levy for this County.

David Shepherd, Gent, with Secy, acknowledged their bond for his Collection of the County Levy.

Ord that Ezekiel Dewitt, Jeremiah Dunn, Edwd Smith, & Zachariah Sprigg, or any 3 of them, view the Most Convenient way for a road from the Court House to Annaniah Davis's Mill & mak report of the Conv. & Inconv thereof to the next Court.

Ordered that the Court be adjourned until the Court in Course.
SOLOMON HEDGE.

(35) At a Court held for Ohio County on monday the 1st day of March, 1779.

Present, Solomon Hedges, Silas Hedges, James Caldwell, Edward Robinson, & Charles Wells, Gent.—Present James Miller.

M^cRobbin

v Attachment

Kerr, Frederick Lamp, Didimus issue to take evidence for Plt.

Ordered that Rawley Martin, an Orphan Child About 14 years of age, be bound to Henry Martin according to Law.

Crow v Hanley, Ordered that Didimus issue to examine plts evidences.

Ordered that David Hall, an orphan Child of three years of Age, be bound to Nathaniel Redford according to Law.

Bargain & Sale from Nathaniel Redford to James Caldwell for six hundred acres of Land & O R

Present, James Gillespie, Gent.

Henry Leven came into Court & took the Oath of Ensign of the Militia & O R to be Certified

Letters of Administration is Granted to Jacob Reager on the Estate of Thos. Worthington, he Complying with the Law.

Ordered that Ebenezer Zane, Conrad Stroup, Saml McCulloch, & Yeates Conaor, or any three of them, being first sworn, do app^{ns} the Estate.

The Last will & Testament of Thos Worthington, deceased, was proved by Ebenezer Zane & Samuel Mason, two of the Witnesses & O R.

- (36) Ordered that John Mitchell, John Willson, John Wiaths, & John McColloch, or any three of them, being first sworn, do app^{rs} the Estate of John Bukey, Dec^d.

Ordered that the Adm of Henry Walls Estate Granted to Peter & Margaret Kintialo, alias Unsell, be revoked, Being Granted contrary to Law, & that the Same be Granted to Catherine Wall, Widow, who Entered into Bond

Certificate of a Stray rec^d and O R.

Orderd that W^m Peak, Thos Waller, Sam^l Mason, & James Clemens, or any three of them, being first sworn do app^{rs} the Estate.

Bargain & Sale from W^m Hawkins to James Caldwell for a tract of Land & OR.

Bargain & Sale from Jesse Martin to Thos Holbore & John Batsell for a tract of Land & O.R.

Bargain & Sale from W^m Hawkins to Thos Edgington for a tract of Land & O.R.

Bargain & Sale from John Boggs to James Clerk for 400 Acres of Land & OR

Certificate of Stray Hogs recd & O.R.

Appraismt of the Estate of Samuel White is returned to Court & OR.

Bargain & Sale from Walter Jerdon & Henry Moore for a tract of Land to John Mecombs & OR.

Bargain & Sale from W^m Caldwell to James Fisk for a tract of Land & O.R.

B & S from W^m Caldwell to W^m Williams ackd & O.R.

| | | |
|--------|---|------------------------------------|
| Steel | } | Case dam £ 250. |
| v | | W ^m Hawkins Enters S.B. |
| Dewitt | | |

- (37) Samuel Irwin took the Oath of An Atty at Law & is Admitted to Preach as Such in this Court.

The Last will & testament of James Leper was proved in Court by Arch^d Brownlee & John Gibby, & OR, and on the Motion of Margaret Leper, Certificate is granted her on the estate of James Leper, she having complyd with the Law. Ordered that John Brownlee Sam^l buyers, Chas Dodd, & John Allison, or any three of them being first sworn do app^{rs} the Same

B. & S. from Matthias Allto to Joseph Alixander ackw & O. R.

Ordered that Isaac Taylor, James Andrew Piter Killer & John Bess, or any three of them, being first sworn do view the the nearest & best way for a Road from the Court house to Annaniah Davis Mill & make report of the Conveniences & Inconveniences of the Same

B. & S. from John Carpenter to Francy Ryley Acknowledged & OR

Grand Jury Presentments

Commonwealth v Samuel Grahams ; Not Guilty

Thos M^cGuire,

Walter Jordon ; Not Guilty.

Peter Keller ; Fined.

Kenneth M^cClelland, Fined.

W^m Biggs ; Fined

Ordered that the Court adjourn untill 8 OClock tomorrow

EDW. ROBINSON

The Court met according to Adjournment, 2nd March

Present, Soloman Hedge, Silas Hedge, Cha^s Wells, & James Gillespie, Gent.

B & S from Hercules Roney to Joseph Alexander, Acknowledged and O.R.

B & S from Isaac Taylor to W^m Polk proved by one witness & orderd to Lie for further Proof

Present, Edward Robinson, Gent, John Boggs, & James Miller, Gent^m.

(38) Markland }
 v } Discontinued
 M^cBride }

Grand Jury presentments James Gillespie Gent Enters his Dissent

Markland } Ordered that Joseph Arnold & Jeremiah Arnold
 v } Each be allowed two days for attendance as
 M^cBride } witnesses in this Action

M^cClure v Douglas Attach^d Judgment & Sam^l Mason Confesses he has Ten Shillings in his hands

On the motion of Matthias Alts Ordered that his mark the Left Ear a Crop & Slitt & the right Ear half Crop & O.R.

Commonwealth v. M^cGuire Not guilty to which

B & S from Isaac Taylor to David Williamson acknowledged & OR.

| | | |
|--------|---|--|
| Lamb | } | Ejectment |
| v. | | Ordered that Didimus Issue to take witnesses |
| Dewitt | } | Depositions for plt |

| | | |
|----------------------|---|--|
| M ^c Bride | } | Eject |
| v. | | Ordered that Didimus Issue to take Witnesses |
| Wolf | } | Depositions |

Ordered that the Sheriff Summons a Grand jury to attend next may Court

Commonwealth v. John Warford, the Atty for Deft objects to the validity of the Grand jury, Annanias Davis, one of them, being an occupier of a Mill ; upon hearing the same the Court is of Opinion that the Same be quashed.

Ordered that the Sheriff pay the money for the Publick buildings as soon as collected to Isaac Taylor, Rob^t Taylor — (David Williamson Jacob Wolf Sarah Taylor David Williamson Jacob Wolf)

Ordered that Matthias Alt be allowed the Sum of fifteen pound for keeping Joseph Taylor a soldier For One Year past, that a Draft be drawn on the Treasurer for the same

(39) Appraisment of the Estate of Gabriel Cox, Deceased, is returned to Court & OR.

Wolf v Maulson, Acc^d proved & Judg

Clemens v Maulson, Judg for £21-17

W^m Caldwell v Gellespy, order for Dedⁱ to Examine Evidence

Ord, that the Court be Adjourned untill tomorrow 8 oclock.

SOLOMON HEDGES

The Court met according to adjournment 3^d March, Present, Solomon Hedges, Silas Hedges, E^d Robinson & John Boggs, Gentlemen, present.

Williamson v Douglas Dismissd

Hedge v Dunbar, Dismissd.

Glen v Douglas, abates by Plt.^s marriage.

Issues

McBride v Wolf, Eject Cond.

Taylor v. Caldwell, Cond.

References

Gillespie v Wheat, Disd.

Hawkins — Ogle, Cond.

— Wheat, Cond.

DeLong — Flanagan, Disd.

Hanley — Walker, Discd.

Roney — Hawkins, Discd.

Martin — Williams, Cond.

— Cunningham, Cond.

— Dement, Cond.

— Martin — Henry Martin Deft by General Rule

Tilton — Hildebrand Disd.

Com — Seamon Cond.

Scott — Caldwell

Walker — Hawkins Discond.

Crow — Handley, Not Guilty with Leave & Joined

Smith — Hawkins, Cond.

Virgin v Nichols, C O.

Taylor v Templeton, Cond. Plea Joined.

Maulson v Arnold, Discd.

McClure v Hildibrand, Dismd.

Rogers v Carpenter, Not Guilty, Joined.

McClure v Dunn, Judgment Finall.

(40) Caldwell v Gillispie, Not Guilty & Joined.

Huff v Berwick, Discond.

Berwick v Huff, Discd.

Huff, Decd.

Wells v Carpenter, John Carpenter Deft & General P L.

Hawkins v Kintialo, Cond.

Tumbleston v Mason, Payment, Joined.

Martin v Leet, Discd.

Virgin — Brownlee, Dismd.

Taylor v Caldwell, Not Guilty with Leave & Joined.

Caldwell v Taylor, Not Guilty with Leave & Joind.

Kintialo & wife — wall, Discd.

Gilliard — Hawkins, Pendleton Security for Cost conditions performed Cond.

Caldwell v. Taylor, not guilty with leave joined.

Sprigg v Dunn, Dismd.

Walker v Handley, Disd.

J. Handly — Crow, Dismd.

M. Handly — Crow, Dismd.

— Crow, Dismd.

Hannah — Johnston, CO.

Kelly — Douglas, Dismd.

Dickens — Flinn, Dismd.

Lyons — Caldwell, Dismd.

Dewitt — Dunn, Cond.

Robeson — Wheat, Agreed.

Grewes — Davis, Dismd.

Saunders — Smyth, Dismd.

Smyth & wife — Saunders, Dismd.

Kelly — Douglas, Dismd.

McClure — Lyons, Dismd.

Lloyd — Cole, Dismd.

Dewitt — Warford, Dismd.

Petitions

Hawkins — Kintialo, Cond.

Huston — Mason, Judgt.

Appearances

Stroup — Clerk, agreed.

Seamon — Carn, CO

Hawkins — Wheat, Agreed.

R. Taylor — Williamson, Sp Imp.

S. Taylor the same, Sp Imp.

Buchanan — Mason, Sp Imp.

Keller — Clerk, Dismd.

Steel — Dewitt, Sp Imp.

(41)

Appearances

Bukanan — Mason, Sp Imp.

Harton — Hawkins, Sp Imp.

— Taylor, Sp Imp.

Madison — Stricker, Lawrence Stricker Enters Deft. Not Guilty Joined.

Lamb v. Dewitt, Ezekiel Dewitt Deft, Not Guilty & Joined.

Ordered that Charles Wells, David McClure, Isaac Taylor & Ebenezer Zane be and the same is hereby appointed to view & Give their Opinions to any money brought before them to know whether it be good or not.

Ordered that Isaac Meek, Derrick Hogland, Ed Robeson & John Shaw, or any three of them, being first Sworn, do view the nearest & best way For a Road from James Millers to the Court house, and make report of the Conveniences and Inconveniences of the same.

Ord that this Court be adjourned untill Court in Course

SOLOMON HEDGES

At a Court held for Ohio County April 5th 1779 ; Present Silas Hedges, Ed Robinson, James Miller, Charles Wells, & Solomon Hedges Gentm.

Ordered that David McClure Sind to Oldtown, Maryland, for the Books Left there by Doctor McMechen, for the use of this County, & that the Sheriff reimburse him what he pays for the same.

Patrick McGaughen v Spendall, Joseph Wells Enters himself Deft. O R

Keller v Clark, acct Proved £36. Jud^t & O R

Ordered that Cha^s Wells mark a crop & hole in the right Ear & brand C W & O R

Ordered that Joseph Wells mark a swallow fork in the Right Ear & under bitt & under bitt in the Left and his Brand I W & O. R.

Robert Woods came into Court & took the Oath of Surveyor for this County & gave bond

Ord : that this court be adjourned to Court in Course.

SOLOMON HEDGES.

At a Court held for Ohio County Monday, 3rd May, 1779.

Present Solomon Hedges, Silas Hedges, George McColloch, Ed Robison & Charles Wells, Gentlemen.

The appraisement of the Estate of John Buckey is returned to Court & O. R.

Ordered that Thos. Gardner be Exempted from paying any Further Levy in this County.

Present James Miller, Gent.

Bargain & Sale From Go. McColloch to Chas. Wells acknowledged and O. R.

Ordered that the Treasurer of this Commonwealth pay unto Andrew Robeson the sum of Twenty-five pounds, being allowed Ann Flemming for her support, her husband being in Continental Service.

Bargain & Sale from Dewit Hogland to Isaac Meek acknowledged & O. R.

James Miller v. Thomas Clerk attach^t & ans Proved £ 12 judgm^t.

Bargain & Sale from Thomas Clark to John Chapman, acknowledged & O. R.

Bargain & Sale from Will^m Bayley to Geo. Parker, acknowledged & O. R.

Ordered that the Treasurer of this Commonwealth pay unto Samuel McColloch the sum of Eighty pounds being allowed Mary Ogle for her support, her husband being killed in the Continental Service.

Bargain & Sale from Jonah Seaman to Geo. Stephenson, acknowledged & O. R. Jno. Mitchell, Security for pay.

Present John Boggs and James Gillespie, Gentleman.

Bargain & Sale from Robert Taylor to Ezekiel Boggs acknowledged & O. R.

On the motion of David McClure, ordered that his mark a crop in the right ear and hole in the same and crop in the left ear and hole in the same be recorded.

Bargain & Sale from Samuel McColloch to Moses Williamson, acknowledged & O. R. S. Mason pays Costs.

Bargain & Sale from James Richardson to John Chapman. Proved by Isaac Taylor one of the witnesses and ordered to lye for further Proof.

Bargain & Sale from Samuel Williamson to Joseph Arnold, acknowledged & O. R.

Bargain & Sale from Moses Williamson, Jun^r, to Samuel

Williamson. Proved by Murtey Handley one of the witnesses and ordered to Lye for further Proof.

Bargain and sale from Joseph Arnold to Samuel Mason, Proved by Murtey Handley and Samuel Williamson, two of the witnesses, and ordered to lye for further proof.

Ebenezer Zane and Samuel McColloch being mentioned in the Didimus, came into Court & took the oath of justices of the peace & took their seats accordingly.

Bargain & Sale from Patrick Magahan to Laurance McCaran acknowledged & O. R.

- (42) At a court held for Ohio County 4th October, 1779 : Present Solomon Hedges, Silas Hedges, Zachariah Sprigg, James Miller, & Geo McColloch, Gentlemen.

The Commissioners for viewing the Clerks Office have made a return of the same Ordered that the same be Recorded.

Ordered that a License for Keeping an Ordinary be Granted unto Zachariah Sprigg he Complying with the Law; then s^d Zachariah Sprigg Came into Court and Gave Dorrick Hogland for his Security

Kelly v Williamson, Dismist at Plts request.

Davis v French, Dismist at Plts request.

Commonwealth v Slidgegar, Dismised, Samuel Grahams Cost

Appraisment of a Hog returned to Court & OR

Hannah v Johnston, Dismist at Plts Request.

Ordered that the Clerk of this Court Certify Unto the Auditors of this Commonwealth that Mary Knox, Widow of Thos Knox, Deceased, was a serjant in Stephen Ashby's Compy in Colo. James Wood's Regiment and is Now Entitled to half pay Since March 177-.

B & Sale from Jonah Seaman to W^m Harris, Acknowledged & OR.

Seaman v Corn, Dismised at Plts Request.

Corn v Seaman, Dismised at Plts Request.

Graham v Hill, Judgment for five pounds Equiv. to four pounds, Current Money of this State.

the Commissioners for Laying out a road from wells Mill, on Cross Creek, to the Court house, has Returned to Court their Report, ord that the Same be Recorded

Ordered that Francis McGuire do Act [overseer] of the Above Road, & that he summons all the tithables within three miles Each way.

- (43) Samuel Graham then Came the Parties & Jointly Prayed
 v that the Differences between them may
 James Hannah be Enquired of by the Court without
 the Formality of a Declaration. Ordered that the Sheriff
 Cause a Jury to Come before the Court Immediatly to Enquire
 of the Same ; Whereupon Ezekiel Dewitt, Annaniah Davis,
 Jacob Newland, John Carpenter, Jonah Seaman, Jeremiah
 Dunn, Christian Slidegar, Joseph Worley, Derrick Hogland,
 James McBride, W^m Harris & James Parks were Sworn.

The Jurors Agree that James Hannah, Deft, pay the Plt
 Samuel Graham ten Dollars and that the Plt Samuel Graham
 pay the Costs of Action and One Shilling Damage

EZEKIEL DEWITT.

McColloch v Sutherland, James Garrison S B.

Ordered that the Clerk Deliver Unto Robert Woods Sur-
 veyor of this County, four Blank Books & four Alphabets for
 said Books, for the Surveying Department of this County.

Moses Holliday v Henry Nelson, John Carpenter SB

Commonwealth v Jacob Drinnen, Fined.

v Joseph Paull, Cond.

v Kennith McClelland, Fined.

v McGinnis — Fined

v Huston — Fined

v Harris — Fined

v Wolf — Fined

v Graham — Fined

v Sprigg — Fined

v Altt — Fined

v Gillespy — Fined

v Miles — Fined

v Warford — Fined

v Dewitt — Not guilty

v Smith Fined

v Biggs Fined for Retailing Liquors.

- (44) Common Wealth v Huff, Fined one Oath
 v Huston, Find one Oath
 v Harris, Find one Oath
 v Williamson, Do Do
 v Willson, Do Do
 v Bowling, Do Do
 v Dodd, Do Do
 v Virgin, Do Do
 v Taylor, Do Do

as Common Swearers

Ordered that the Sheriff Summons a Grand Jury to attend Next Month

Ordered that Susannah Fisher, an Orphan Child, be bound Unto Solomon Hedges according to Law. And that said Hedges pay unto sd Orphan the Sum of thirty Dollars Over & Above the Sum allowed by Law to Orphans at the Expiration of their time.

on the Motion of Joseph Worley Ordered that Samuel Teter, W^m Sparks, Joseph Worley & John Ferguson, or any three of them, being first Sworn, do View the Nearest & best way for a Road from John Boggs Mill to Alexr. Wells, on Cross Creek, & make Report to Next Court.

Ordered that this Court be adjourned Untill Court in Course

SILAS HEDGES

- (45) At a Court held for Ohio County Monday 1st November 1779; Present, Solomon Hedges, Silas Hedges, W^m Scott, James Gillispy, Gents.

B & Sale from Isaac Taylor to William Polk, being formerly Proved by Thomas Gilliland & now Proved by Hugh Gilliland, OR

B & Sale from James Clemens to Robert Taylor, Acknowledged & OR

B & Sale from Edward Smyth to Isaac Smyth, acknowledged & OR.

Ordered that Andrew Ramsey do Act as Oveer from Wells' farm to Buffalo Creek, and Derrick Hogland From s^d Creek to the Court house, and that the Summons all the Tithables within three miles Each side the road to Work on sd Road

Administration of the Estate of Joseph Miller Deceased is Granted to James Clemens, he Complying with the Law ; then sd Clemens gave Rob^t Taylor as his Surety. Ordered that Harry Martin, W^m Johnston, Rob^t Taylor, & Sammel Johnston, or any three of them, being first sworn, do appraise the Estate

Thomas Scott¹ Came into Court and took the Oath of an Attorney at Law and is Admitted to act as such

Present, Edward Robinson, Samuel M^cColloch, Gent.

Ordered that Robert Guthry be Summoned to Appear at Next Court to Declare what part of the Estate of Joseph Miller, Deceased, Remains in his hands

A Grand Jury for this County being Called, Samuel Mason was Sworn as Foreman, then W^m Sparks, James Garretson, John Carpenter, John Chapman, Joseph ogle, Joseph Wells, Charles Hedges, Thos Gilliland, Ezekiel Dewitt, Daniel Harris, Levy Mills, Thomas Chapman, Joseph Hedges, & Andrew Fouts was sworn

B & Sale from Joseph Wells to Isaac Miles, Ack & OR

(46) Appraisement of the Estate of John M^cColloch, Deceased, Returned to Court & OR

| | |
|----------|--|
| Gillespy | } Ordered that the Defendant be Summoned |
| v | |
| Dickeson | |

to Next Court to Give sp. bail

Administration of the Estate of Samuel Kennedy is Granted to James Buchanan, he Complying with the Law ; then s^d Buchanan Came into Court & Gave David M^cClure as his Surety

Ordered that Thomas Waller, Thos. Peek, David Hosack, & Neal Gillespy, or any three of them, being first Sworn, do appraise the Estate and make report to next Court.

B & Sale from W^m Hawkins to Peter Hildebrand, acknowledged & OR.

¹ Could this have been Thomas Scott, an adherent of the Pennsylvania jurisdiction, arrested by John Connolly's posse and taken before Lord Dunmore at Redstone Old Fort, in November 1774, just after the close of "Dunmore's War?" See Crumrine's History of Washington County, 178. That Thomas Scott resided on Dunlap's Creek near Redstone Old Fort, and on the organization of Washington County, Pennsylvania, became the first prothonotary of the new county, and was its representative in the First Congress of the United States.

Ordered that a Licence for keeping an ordinary be Granted unto Edward Smith, he Complying with the Law; then s^d Smith Came into Court and Gave John Huff as his Surety.

Ordered that James Clemens take Care of the Real Estate of Joseph Miller Deceased, untill Further Orders.

Hawkins v Jacob & Mary Miller, Jacob Lefler SB.

Worley } Ordered that the Plt be Summoned to appear at
v } next Court to Prosecute this Action or the same
Huff } will be Dismist.

the Commissioners for Laying out a Road from Davis Mill to Court house Returned their Report to Court & OR.

Return of an Inquisition held by Chas. Wells & James Miller, Gent, Returned to Court & OR.

the Grand jury having made Severall presentments, Ordered that the Severall offenders be Summoned to next Court

B & Sale Isaac Miles to Joseph Smyth, ackd & OR. John Polk Security for Costs

- (47) Buskirk } Ordered that a Didimus Issue to take the Ex-
v } amination of Elizabeth Ash for the Plt.
Barber }
Rogers }
v } Dismist
Carpenter }

Ordered that this Court be adjourned untill tomorrow morning at 8 O'Clock

SOLOMON HEDGES

The Court Met According to Adjournment; Present, Solomon Hedges, Silas Hedges, Edward Robison, James Gillespie, W^m Scott & Zachariah Sprigg, Gent.

Rogers } Ordered that Elijah Huff be allowed for four
v } days attendance a Witness
Carpenter }

Rogers } Ordered that Luke Scarmehorn be allowed For
v } five days Attendance as a witness and Likewise
Carpenter } ordered that Jacob Fokler be allowed For five
days attendance in this Action as a witness

Robeson } Attachment; the Sheriff returns he has Attached
v } one hundred acres of Land or one half of a Sur-
Ashby } vey and Summoned Isaac Taylor as a Garnishee

Isaac Taylor Came in, by Thos Scott his Atty, and moved that the s^d Attachmt should be Quashed, Supposing the Same to be Improperly Brought; on Consideration the Court is of Opinion that the Same Shall Lye.

Ordered that the Court be adjourned to meet Immediately at Zachariah Spriggs Gent

SILAS HEDGES

(48) The Court met According to adjournment. Present, Solomon Hedges, Silas Hedges, W^m Scott, Edward Robison & James Gillespy, Gent.

Then the Court Proceeded to Levy the County Levy

| | |
|--|------------|
| To James McMechen by acct | £80. 17. 8 |
| To David M ^c Clure for Extra Services | 31. 13. 2 |
| To James Gillespy by acct | 1. 0. 0 |
| To Thomas M ^c Intosh by acct | 36. 12. 0 |
| To W ^m Nimmons by Acct | 6. 12. 0 |
| To David Shepherd for Extra Services for 1 year | 28-14- 0 |
| To David Shepherd for Express to Winchester or Ruther Zane's work | 100 0 0 |
| | £285- 8-10 |
| To David Shepherd for Ball ⁿ of Last years acct | 14- 6- 6 |
| | £299-15- 4 |
| To Sheriff for Collection | 21 0 0 |
| To a Depositum in the Sheriffs hands | 31 14 8 |
| | £352-10- 0 |
| By 470 Tithables a 15s Each | £352 10 0 |

James Gillespy pd 5s, having recd that Sum for drunkenness

B & Sale from Robt Cwam to Charles M^cBride, Proved by James Gillespy one of the witnesses and Ordered to Lye for further proof.

M^cBride v Wolf, Cond.

Taylor v Caldwell, Cond.

Scott v Caldwell, Cond.

Caldwell v Mason, Cond.

Crow v Handly, Cond.
Taylor v templeton, Cond.
Caldwell v Gillespy, Dismist.
Wells v Carpenter, Agreed.
Tumbleston v Mason, Dismist.
Taylor v Caldwell, Cond.
Caldwell v Taylor, Dismist.
v the same, Dismist.

Ordered that the Sheriff Collect 15s from Each tithable Person within this County

- (49) Hawkins v ogle, Cond.
v Wheat, Cond.
v Kintialo, Cond.
Jesse Martin v Williams, Cond.
v Cunningham, Cond.
v Dement, Cond.
v Martin, Cond.
Smith v Hawkins, Cond.
Hawkins v Kintialo, Cond.
Gilliard v Hawkins, Cond.
Virgin v Niccols, Cond.
Dewitt v Dunn, Cond.
Taylor v Williamson, Cond.
Sarah Taylor v Williamson, Cond.
Buchanan v Mason, Dismist.
v the same, Dismist.
Huston v Sayler, Cond.
Maddison v Stricker, Cond.
Lamb v Dewitt, Cond.
McGaughan v Wells, Con.
Miller v Cox, Cond.
v Geo & Mary Sparks, Cond.
Clerk v Huff, Cond.
Williamson v McBride, Cond.
Lamb v Wells, Agreed.
Mason v. McBride & Wilson, Cond.
Gillespy v Dukeson, Cond.
Buskirk v Barber, Cond.
Cox v Cane, Cond.

Barber v Spencer, Cond.
 Worley v Huff, Cond.
 M^cEntire v Carpenter, Dismist.
 Huff v Ryley, Agreed.
 Flahavin v Huston, Cond.
 English v Curry, Cond.
 Holliday v Nelson, Cond.
 M^cColloch v Sutherland, Cond.

Appearances

Hawkins v Miller, Cond.
 v Guther, Agreed.
 Moore, agreed.
 (50) Huff v Boner, Agreed.
 French v Graham, Cond.
 Commonwealth v Paul, Judgn^t for £10 & Costs

Petition and Summons

Hawkins v Kintialo, Con^d.

Attachment

Robeson v Ashby, Cond.

Ordered that Ezekial Dewitt do act as overseer for the Opening the Road from Boggs Mill to the Court house & that he Summons the tithables within one mile to North of sd Road & the tithables within three miles of the South of sd Road to work thereon.

Ordered that Samuel Mason do act as an oover to make a Road from Jacob Wolfs to Thomas Wallers, and that he Summons the tithables within Three Miles Each side said Road to work thereon.

Ordered that David Shepherd, Brice Virgin, Rich^d Dickerson, & Daniel Leet, or any three of them, being First Sworn, do View the Nearest & best way for a Road from Jacob Wolfs to the County Line Leading towards Redstone, & make Report to Next Court.

Ordered that a Review be made for a Road from W^m Hawkins to the Forks of Whelan, & that W^m Hawkins W^m M^cEntire, David Shepherd, & Samuel Mason, or any three of them,

being first Sworn, do view the Same and make Report to next Court.

Ordered that Thomas Waller, Cha^s Boner, David English, and Andrew Robinson, or any three of them, being first Sworn, do view the nearest and best way for a Road from Wallers fort to the County Line, Leading Towards Crawfords ferry, & make Report to next Court

Commonwealth v Isaac Taylor ; a Number of Depositions being returned to Court against the Deft. the Court on Consider are of Opinion that the s^d Taylor Be Dismissed

(51) Ordered that this Court be adjourned Until Court in Course
SILAS HEDGES

At a Court held for Ohio County, on Monday the 6th Day of March, 1780, Present.

Solomon Hedges, W^m Scott, James Caldwell, & George M^cColloch, Gent.

Ordered that a License be Granted unto John Biggs to keep an ordinary at his house, he Complying with the Law ; Whereupon sd John Came into Court and Gave Charles Hedges as his Surety. Present, Ebener Zane & Charles Wells, Gent.

Admn of the Estate of Thos Ryan, dec^d, is Granted to Silas Zane, he Complying with the Law.

Ordered that John Mitchell, Benjamin Hammitt, Joseph Vanmeter, & Jacob Reager, or any three of them, Being first Sworn, do appraise the Estate of Tho^s Ryan.

Joseph Beeler came into Court And Proved his Service as a Captain in the Virginy Service in Col^o Brocodes [Bouquet's] Campaign ; he Likewise proved his being a Waggon master in General Forbes Campaign.

Present, James Miller, James Gillespy, Gen^l.

Carpenter v Rogers, Benjamin Biggs Enters S Bail.

Cox v Cane, slander. Ordered that a Didimus Issue to take the Deposition of Sarah Barber for the Plt

Wheat v Conner, slander. Ordered that a Didimus Issue to take the Deposition of James Beagham for Plt.

(52) William Flavhavin }
v } debt
William Huston }

Then Came the Parties and Jointly Prayed that the Differences Between them may be Enquired of by the Country without the form of a Declaration. Ordered that the Sheriff summons a Jury to attend Immediately to Enquire of the same: Whereupon James Clemmens, Jesse Martin, James Parks, James Moore, John Warford, James Andrews, Jacob Newland, James Garretson, Jacob Reager, Benjamin Biggs, Nicholas Rogers, & Samuel Mason, who being duly Elected and Sworn do say : ¹

Ordered that William Scott, Silas Hedges, Gent, be recommended to his Excellency to appoint One of them to Serve as a Sheriff in the Room of David Shepherd.

John Carpenter fully proved to this Court that he served as a Soldier in the Old Virginy Regiment before 1763.

Matthew Fowler fully proved to this Court that he served as a Corporall in the Old Virginy Regiment before 1763

that ² the Assess the Plts damage to Seventy pounds sixteen shillings ; but it is Considered by the Court that this Judgment be Discharged by the payment of thirty Five pounds Eight Shillings, & Costs.

Ordered that a Licence be Granted Unto James Gillespy, Jun^r, to keep an Ordinary at his house, he Complying with the Law ; Whereupon sd James Came into Court & Gave William Scott as his Surety.

Jesse Martin Came into Court & Fully proved his Service as an Ensign in the State of Virginy in the year 1758.

Jesse Martin Came into Court and proved his Serving as an Artificer in the Virginy Service in the year 1760.

(53) Joseph Worley v. Elijah Huff, Ordered that the Same Be Dismissed

Ordered that Andrew Scott be Appointed Constable For the Ensuing year in the Room of Jacob Reager.

James Parkes Proved to this Court that he Served as an artificer in the Virginy Service in the year 1760, and Ordered to be Certified.

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| John Carpenter | } | Attachment, the Sheriff Returns he Could find no |
| v | | |
| James Karr | | |

¹ See verdict, *infra*.

² See beginning of entry, *supra*.

Goods, but has Summoned Arthur McConnell as Guarnishee. Ordered that the same Lye Over Untill to Morrow.

Wheat v Conner, Slander. On the Motion of the Deft that he should only be held to Common Bail, the Court Ordered it so.

Ordered that this Court be adjourned to meet at Zachariah Spriggs tomorrow at 8 o'clock.

WILLIAM SCOTT

The Court Met according to adjournment: Present, James Caldwell, George McColloch, Ebenezer Zane, & James Gillespy, Gents.

Certificate of a Stray Heifer is returned to Court by James Gillespy, Gent, & O.R.

Certificate of a mare is Returned to Court by John Boggs, Gent, & O.R.

(54) Certificate of a Stray Sow returned to Court by James Gillespy, Gent, & OR.

Certificate of a Stray Heifer is returned to Court by Charles Wells, Gent, & O.R.

Certificate of a Stray mare is returned to Court by Charles Wells, Gent, & OR.

Certificate of a Stray Colt is returned to Court by W^m Scott, Gent, returned to Court & OR.

Certificate of a Stray Hogg is returned to Court by James Gillespy, Gent, & OR.

Certificate of five Stray Hogs is Returned to Court by W^m Scott, Gent, & O R.

Certificate of a Bay mare is returned to Court by W^m Scott, Gent, & O R.

Ordered that Edward Geither be summoned to attend at Next Court to answer the Complaint of his Late Servant John Rower.

Present W^m Scott, Silas Hedges, Jas. Miller, Gent.

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| John Carpenter | } | Attachment. Ordered that John Doldridge, Arthur McConnell, John Huff, William Sparks, & Thomas Uri, be and they are hereby appointed to Settle all Disputes in this Action Between the parties and make report to next Court. |
| v James Kerr | | |

Davis v French, Jeremiah Dunn Enters himself Special Bail.

Worley v Huff ; Ordered that Michael Huff Be allowed For three days attendance Before November, & three days Since Nov as a Witness in this Action.

Hedges v Tilton, Ordered that the same be Dismissed at Plt request.

(55) Certificate of a Stray Steer is returned to Court by James Miller, Gent, & OR.

Sarah Taylor

v

David Williamson Dismissed at Plts Request.

Robert Taylor

v

David Williamson Dismissed at Plts Request.

Appearance^s

Wheat v Kerr, Alias

Conner, Continued.

Beagham, Alias

Hawkins v Miller, Continued,

Wall v Miller, Alias.

Carpenter v Rogers, Continued & Set to Sept for tryall

Smyth v Curry Alias.

Garretson v Robinson, Settled & Costs paid.

Stroup v Williamson, Continued.

Hawkins v Rower, Continued.

State & Gillespy, v Virgin, Alias.

Gillespy v Virgin, Alias.

Tombleston v Mason, Alias.

Snowden v Alexander, Alias.

Lutes v Miller, Continued.

Roany v Smyth, Alias.

Mills v Stroup, Alias.

Wheat, Alias.

Tule Fitzgerald, Alias.

McGee Russell, Alias.

Davis v French, Continued.

Hedges v Tilton, Discontinued at Plts request, Costs paid.

- Parks v Cox, Discontinued at Plts request Costs paid.
Miller v Lutes, Continued.
Ryley v Rogers, Continued.
(56) M^cBride Wolf, Continued.
Taylor v Caldwell, Continued.
Scott v Caldwell, Issue for tryal next Sept Court
Caldwell v Mason, Discontinued.
Crow v Handly, Continued.
Taylor v Templeton, Continued.
v Caldwell, Continued.
Hawkins v Ogle, Continued.
v Wheat Continued.
Kintialo, Eject. Judgment
Martin v Williams, Continued.
v Cunningham, Continued.
Dement, Continued.
Martin, Continued.
Smyth v Hawkins, Discontinued.
Hawkins v Kintialo, Trespass, Judgt & Writt of Enquirey.
Gilliard v Hawkins, Discontinued.
Virgin v Nichols, Continued.
Dewitt v Dunn, Discontinued.
Huston v Saylor, Discontinued.
Maddison v Stricker, Continued.
Lamb v Dewitt, Continued.
M^cGaughan v Wells, Continued.
Miller v Cox, Continued, set for tryal.
v Geo & Mary Sparks, Issue for tryal to Sept^r.
Clerk v Huff, Continued.
Williamson v M^cBridè, Discontinued.
Mason v M^cBride & Wilson, Discontinued.
Gillespy v Dickeson, Discontinued.
Buskirk v Barber, Continued & Set Sep^r for tryal.
Cox v Cane, Continued.
Barber v Spencer, Continued.
English v Curry, M^cKnight & Blackburn, Continued to
Sept next for tryall.
Holliday v Nelson, Continued.
M^cColloch v Sutherland, Continued.

Hawkins v Miller, Discontinued.

French v Graham, Continued.

Appearances

(57) Davis v Tilton, Continued.

Cox v Mummey, Continued.

Delong v Snitiker, Alias.

Petition & Summons.

Hawkins v Kintialo, Judgmt, Fa Fie.

Attachments.

Robinson v Ashby, Discontinued at Plt^s request.

Carpenter v Kerr, Continued.

Bolin v Dowlin, Continued.

Presentments

Commonwealth v Smyth, Continued

v Keller, Continued

v Moore, Continued

v Biggs Senr, Continued.

v Harris, Continued.

v Paul, Continued.

v Zane, Continued.

v Rogers, Continued.

v Graham, Continued.

Taylor Ordered that Eleazer Williamson be allowed
v for two days attendance as a witness in this
Williamson action. And Likewise Ordered that David
Frame be allowed for two days attendance in this Action.

Bargain & Sale from Patrick M^cGaughan to Joseph Scott,
proved by W^m Scott, one of the Witnesses, & Ordered to Lye
for further Proof.

Bargain & Sale from Fulton to Dunlap, proved by Ed Rob-
inson & And^w Robinson, two of the Witnesses, & OR.

Bargain & Sale from Kidd to Fulton, proved by Edward
Robinson & And^w Robinson, two of the Witnesses, & O.R.,

Ordered that the Court be adjourned Until Court in Course

SILAS HEDGES

- (58) At a Court held for Ohio County on Monday 3d day of April. Present, Salomon Hedges, Silas Hedges, W^m Scott, & Edward Robeson, Gent.

Appraisment of the Estate of Samuel Kennedy, Deceased, is Returned to Court, & O.R.

Bargain & Sale from Patrick M^cGaughan to Joseph Scott, Being formerly Proved by W^m Scott & now Proved by Andw. Scott, sd Lands Adjoin the Land of sd McGaughan on the south James Marshall on the North Andrew Scott on the West, & OR

Stroup v Williamson, Dismist for Non Prost. Ordered that Thomas Williamson Be allowed for one days attendance in this action

M^cColloch v Sutherland ; Judgment for One hundred & Sixty Pounds with Costs upon Nihell Dicitt. Ordered that this Court be adjourned Untill tomorrow 8 Oclock

SOLOMON HEDGES.

The Court Mett According to Adjournment ; Present, Solomon Hedges, Silas Hedges, Edwd Robeson, & Zachariah Sprigg, Gentlemen.

On the motion of W^m Hawkins, Ordered that his mark a Cropp of the Left Ear & Slitt in the Right be Recorded.

On the motion of Henry Green, Ordered that his mark a Cropp of the Left Ear & hole in the same & slitt in the Right Be Recorded. W^m Hawkins Security for Costs.

Ordered that the Sheriff Summons a Grand jury to attend the Next Court

Ordered that Samuel Hill, an Orphan Child about 3 years Old; be bound unto David Caldwell according to Law, if the mother of sd Child will give her Consent to the Same.

- (59) Common Wealth v E^d Smyth for Retailing of Spiritious Liquors ; Judgment for Ten pounds & Costs.

v Peter Keller, Judgment for Ten pounds & Costs.

v James Moore, Judgment for Ten pounds & Costs.

v Benj^m Biggs senr. Judgment for Ten pounds & Costs.

v John Harris, Judgment for £10 & Costs.

v Jacob Paul, Judgmt for £10 & Costs.

v Nicholas Rogers, for prophane Swearing.

Judgment for 5 s. and Costs

v Samuel Graham Judgm^t for 5 s & Costs.

Bethsheba Randle, Heiress at Law to David Randle who was killed on the field of Battle, Proved to this Court S^d David Randle Served a Lieut in the Regular Service in the Year 1763, & O.R. that the Same be Certified.

James Park Proved to this Court that he Served as a Serjant in the Regular Service in the Year 1763, & OR that the same be Certified

Wheat v. Kerr, Plu Capias.

v. Beaghm, Plu Capias.

Wall v Miller, Plu Capias.

Smyth v Curry, Plu Capias.

State & Gillespy v Virgin, Plu Capias.

Gillespy v Virgin, Plu Capias.

Tomlinson v Mason, Plu Capias.

Snowden v Alexander, Dismist at Plt^s Request.

Berry v Smyth, Plu Capias.

Mills v Stroup, Plu Capias.

v Wheat, Plu Capias.

———v Fitzgerald, Plu Capias.

M^cGee v. Russell, Plu Capias,

Delong v Snidiker, Plu Capias.

Carey v Robinson, Con^d.

Taylor v Williamson, Con^d.

Caldwell v Martin, Cond^d.

(60) Carpenter v Bailey, All Capias.

Caldwell v Taylor, All Capias.

Graham v M^cDonald, All Capias.

v the Same, All Capias.

Zane v Reagan, Dismist.

Dunn v Snidiker, All Capias.

Huston v Sayler, All Capias.

Dewitt v Hupp, Dismist at Plts Request.

Hannah v Spencer, All Capias.

v the Same, All Capias.

Hawkins v Wheat, All Capias.

v Boney, All Capias.

Dunn v Taylor, Cond.

On the Motion of James Hannah Ordered that his mark a
Crop of the Right Ear & hole in the Left Ear be Recorded
Ordered that this Court be adjourned Untill Court in Course
SOLOMON HEDGES

At a Court held for Ohio County on monday the 1st day of
May.

Present, Solomon Hedges, Silas Hedges, Zachariah Sprigg,
& Geo. M^cColloch, Gent.

John Mitchell Came Into Court and Entered himself Security
for the Good Behavior of Joseph Wilson Untill Next Court.

Ordered that this Court be adjourned Untill Seven OClock
tomorrow Morning.
SOLOMON HEDGES

- (61) The Court met according to Adjournment. Present, Solomon
Hedges, Silas Hedges, Geo. M^cColloch, & Sam^l M^cColloch,
Gent.

Certificate of a Stray Steer taken up by And^r Roany, Before
Solomon Hedges, Gent, is returned to Court & O R.

Bargain & Sale from Zephania Dunn to W^m Johnston, Ac-
knowledgeed & O R

Bargain & Sale from Zephania Dunn to Kennith M^cClelland,
Acknowledgeed & OR.

Bargain & Sale from Zephania Dunn to Thomas Gilliland,
Acknowledge O.R.

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| Wheat | } | Dismiss at Plaintiffs Request. |
| v | | |
| Conner | | |

On the motion of Silas Zane, Ordered that his mark a Slope
of the Under side of Each Ear & his Brand S. Z. be Recorded.

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| DeLong | } | Zephania Dunn Enters himself S B |
| v | | |
| Snidiker | | |

| | | |
|----------|---|------------------------------------|
| Dunn | } | Zephania Dunn enters himself S. B. |
| v | | |
| Snidiker | | |

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| Mills | } | Jacob Reager Enters himself S B. Ordered that a Didimus Issue to take the Deposition of Conrad Stroup } Wheat, Jun ^r , for Defendant |
| v | | |
| Stroup | | |

- (62) Dewitt }
 v } Frederick Lamb Enters himself S. B.
 Garrison }

Issues

M^cBride v Wolf, Dismist.
 Taylor v Caldwell, Dismist.
 Scott v Caldwell, Con^d to Sep^r for tryal.
 Crow v Handly, Con^d.
 Taylor v Caldwell, Dismist.
 v Templeton, Dismist.

References

Hawkins v Ogle, Cond to Next Court for tryal.
 v Wheat, Cond to Next Court for tryal.
 Martin v Williams, Dismist.
 v Cunningham, Dismist.
 v Dement, Dismist.
 v Martin, Dismist.
 Virgin v Niccols, Con^d to Next Court for tryal.
 Maddison v Stricker, Dismist.
 Lamb v Dewitt, Dismist.
 McGaughan v Wells, Continued to Next Court for tryal.
 Miller v Cox, Con^d to Sep^r for tryal.
 v Geo & Mary Sparks, Con^d to Sep^r for tryall.
 Clerk v Huff, Contd to Next Court for tryall.
 Buskirk v Barber, Cond to Sep^r for tryall.
 Cox v Cane, Cond to Next Court for tryall.
 Barber v Spencer, Cond to Next Court for tryall.
 English v Curry, Cond to Sep^r for tryall.
 Halliday v Nelson, Cond to Next Court for tryall.
 McColloch v Sutherland, Cond on a Nihell Dicitt, Judgment.
 French v Graham, Dismist at Plt^s Request.
 Hawkins v Miller, Cond to Next Court for tryall.
 Carpenter v Rogers, Cond to Sep^r for tryall.
 Hawkins v Bower, Cond to Next Court for tryall.
 Lutes v Miller, Dismist.
 (63) Taylor v Williamson, Cond to Sep^r for tryall.
 Davis v French, Cond.
 Miller v Lutes, Dismissed at Plt^s Request.

Ryley v Rogers, Dismist at Plt^s Request.
 Davis v Tilton, Dismist.
 Caldwell v Martin, Cond.
 Cox v Mummy, Cond.
 Dunn v Taylor, Cond.

Appearances

Wheat v Kerr, Dismissed at Pl^{ts} Request.
 Wall v Beagham, Dismist.
 v Miller, a 2^d Pl Capias.
 Smyth v Curry, Cond.
 State & Gillespy v Virgin, Attachmt.
 Gillespy v Virgin, Attachmt.
 Tomlinson v Mason, 2^d Pl Capias.
 Berry v Smith, 2^d Pl Capias.
 Mills v Stroup, Cond.
 v Wheat, Cond.
 Tuel v Fitzgerald, Dismissed.
 McGee v Russell, 2^d Pl Capias.
 Delong v Snidiker, Cond.
 Carpenter v Bailey, Cond.
 Caldwell v Taylor, Cond.
 Graham v M^cDonald, Cond.
 v The same, Cond.
 Dunn v Snidiker, Cond.
 Huston v Sayler, Cond.
 Hannah v Spencer, Dismist.
 v The same, Dismist.
 Hawkins v Wheat, Pl Capias.
 v Roney, Pl Capias.

- (64) Bargain & sale from Benj^m Biggs to James M^cKay, Acknowledged & O R

Appearances.

Manly v Rogers, cond.
 Dewitt v Garrison, Cond Plea Not Guilty with Leave & Joinder.
 Davidson v Wolf, alias.
 Lamb v Bailey, Cond.
 Huff v Bailey, Cond.

Cary v Robinson, capias.

Manly }
v } Frederick Lamb Enters himself S.B.
Rogers }

Carpenter v Kerr, Dismist.

On the motion of Ezekiel Dewitt, Ordered that his mark a Crop of the Near Ear be Recorded.

On the Motion of Yeates Conner, Ordered that his mark two Swallow Forks in Each Ear be Recorded.

On the Motion of Christian Snidiker, Ordered that his mark a Swallow Fork in the right Ear and Slitt in the Left Each be recorded.

On the motion of Matthew Kerr, Ordered that his mark a Crop & two Slitts in the Left Ear and upper bitt in the Right Ear be recorded.

A Bond Given to Ezekiel Dewitt by Frederick Lamb is OR

Ordered that Joseph Ogle, David English, David Williamson, Isaac Meek, Thomas Chapman, Samuel Glass, George Humprys, Thomas Gilliland, John Carpenter, Andrew Fouts, Daniel Harris, John Huff & George Dement, Each be Find in the Amount of two Hundred pounds of Tobacco for not Appearing agreeable to Summons as Grandjurymen.

(65) Ordered that Silas Zane, Conrod Stroup, Yeates Conner & And^w zane, or any three of them, being first Sworn, do appraise the Estate of Walter Calhoon, Deceased, the former app^{rs} being moved from that part of the County where the Estate Lyes so as the Cannott Attend.

Frederick Lamb applied this day to Ezekiel Dewitt For a rehearing of the plantation whereon Dewitt now Lives but said Dewitt positively refused.

Bolin } Attachm no Goods found but Summoned sd
v } Dolin as Garnishee & Ordered to be Continued.
Dolin }

Ordered that this Court be Adjourned Until Court in Course
SOLOMON HEDGES

At a Court held for Ohio County on Monday the 5th day of June, 1780.

Present, Solomon Hedges, E^t Robeson, James Miller, & Zachariah Sprigg, Gent.

Joseph Vanmeter Fully Proved to this Court that he Served as a Soldier in a Ranging Compy in 1758 & 1759, Com-manded by Rob^t Rutherford, Cap^t & Comandante & ordered to be Certified

Carey v Robinson, Dismist at Plts request.

Holliday v Nelson, Dismist for Non Prosecution.

Present, James Gillespy, & W^m Scott, Gent.

Delong v Snidiker, debt ; The parties appeared & prayed that their Cause may be Enquired of by their Country without the Formality of a Declaration, Ordered that the Sheriff Sum-mons a Jury to appear Immediately to Inquire of the same. Whereupon Thomas Mills, George Dement, Ezekial Dewitt, Jacob Keller, John Wilson, Tho^s Chapman, James Moore, Joseph Vanmeter, Conrod Stroup, John Mitchell, Daniel Harris & Joshua Russell, who being duly Elected & Sworn, do say that the Assess the Pltf damage to one Shilling & Costs. It is Considered by the Court that this Judgment be Discharged by the Payment of Six pounds twelve Shillings & Costs.

Ordered that Luke Scurmehorn, Sen^r, & Luke Scurmehorn, Jun^r be allowed for One days attendance as Witness in this Action

(66) The award of an arbitration held between Ezekial Dewitt & Frederich Lamb is proved in Court & OR

On the Motion of William Carson Ordered that his mark a hole in the Left Ear & swallow fork in the Right Ear be Recorded.

Ordered that Jennet Clark, Daughter of Kiah Clark, now two Years of Age, be bound Unto William Carson According to Law, Agreeable to her Father & Mothers Request by Letter.

Jeremiah Dun v Christian Snidiker ; Case, Dam £700, then Came the parties & Jointly Prayed that their Difference may be Enquired of by their Country without the Formality of a Declaration. Ordered that the Sheriff Summons a Jury to Appear Immediately to Enquire of the same. Whereupon Thomas Mills, George Dement, Ezekial Dewitt, Jacob Keller, John Wilson, Tho^s Chapman, James Moore, Joseph Vanmeter, Conrod Stroup, John Mitchel, Daniel Harris & Joshua Russell, who being duly Elected and sworn, do say that the Find for the Def^t

THOMAS MILLS, FORMAN.

Ordered that Edward Geither Deliver unto John Bower in one month from this Date Clothing to the Value of two Hundred and Ten pounds to be adjudged by W^m Hawkins & James Clemens to be worth that sum or that sum in money.

- (67) Ezikeal Dewitt v James Garrison ; Case. Then Came the parties & Jointly Pray that their Differences may be Enquired off by their Country without the Formality of a Declaration. Ordered that the Sheriff Summons a Jury to appear Immediately to Enquire of the same, whereupon George Dement, Derrick Hogland, Annaniah Davis, Samuel Glass, James Clemens, Joseph Ogle, Sam^l Mason, And^w Fout, Isaac Meek, John Whitsel, Edward Geither & Daniel Harris.

Ordered that Luke Scarmehorn be Allowed for one Days Attendance in this Action.

State & Gillispie v Virgin, in Attachment ; the sheriff returns there is nothing to be found.

Gillispie v Virgin, in attachmnt ; the sheriff returns there is nothing to be found.

Wall v Miller, Ed Geither, S.B.

Hawkins v Geither, Jacob Miller, S.B.

Bower v Geither, Jacob Miller, S.B.

Davidson v Wolf, Jacob Wolf S.B.

M^cGee v Russell, James Clemens, S.B.

Miller v Wheat ; Ordered that a Didymus Issue to take the Deposition of James Beagham.

Ordered that Tho^s Gilliland, Isaac Phillips, & Isaac Ellis be recommended to his Excellency the Governour as Capt^s, & Timothy Downing, John Carpenter, Henry Nelson, James Brownlee, & John Bean, as Leut^s.

- (68) Thomas Holburt, Matthew Mackland, & Joseph Worley, as Ensigns of the Militia

W^m Scott Came into Court & took the Oath of Sheriff of this County & Entered into Bond Accordingly.

Ordered that a Licence for Keeping an Ordinary be Granted unto Ezekial Dewitt at his house, he Complying with the Law. Whereupon sd Ezekial Came into Court & Gave John Carpenter as his Surety.

Assignment on a Bill of sale Dunn to Gilliland is acknowledged by Tho^s Gilliland to Hugh Gilliland & O R.

Virgin v Niccols, Dismist at Plt^s Request.

Ordered that this Court be Adjourned Until Eight OClock tomorrow morning.

E ROBINSON

(69) The Court Met According to Adjournment. Present, Solomon Hedges, Edward Robinson, James Miller & James Gillispie, Gentlemen.

Ordered that a Licence be Granted unto Jacob Wolf for Keeping an Ordinary at his house, he he Complying with the Law. Whereupon s^d Jacob came into Court & Gave James Clemence as his Surety.

Then the Court Proceeded to Settle the Rates For ordinary Keepers.

Ordered that the Ordinary Keepers in this County sell at the following rates :

| | |
|-----------------------------------|------------|
| For half a pint of whiskey, | 6 dollars. |
| For a breakfast or Supper, | 4 ditto. |
| For 1 dinner, | 6 ditto. |
| For Lodging with clean sheets, | 3 ditto. |
| For 1 horse to hay one Night, | 6 ditto. |
| For pasturage one Night, | 3 do. |
| For 1 Gallon of Corn, | 5 do. |
| For 1 Gallon of Oats, | 4 do. |
| For half pint whiskey with negas, | 8 do. |
| For 1 Quart strong Beer, | 4 do. |

Present Zachariah Sprigg Gent

Scott v Caldwell, Con^d to Sep^r.

Crow v Handly, Cond.

Hawkins v Ogle, Judgmt confesed for Six pounds & Costs.
v Wheat Judgmt for Deft.

McGaughan v Wells, dismissed.

Miller v Cox, Cond to Sept.

v Geo & mary Sparks, Cond to Sept.

Clerk v Huff, Judgmt confessed for £11-4 & Costs.

Buskirk v Barber, Cond to Sep^r.

- Cox v Cane, Cond.
 Barber v Spencer, Dismissed.
 English v Curry, Cond to Sep^r.
 M^cColloch v Sutherland, Cond.
 (70) Taylor v Williamson, Cond to Sep^r.
 Hawkins v Miller, Dismissed at Plts request.
 Carpenter v Rogers, Cond to Sep^r.
 Hawkins v Bower, Dismissed at Plt^s request.
 Davis v French, Cond to next Court for Tryall.
 Caldwell v Martin, Cond to next Court for Tryall.
 Cox v Mummy, Cond to next Court for Tryall.
 Dunn v Taylor, Dismist.
 Smyth v Curry, Cond to next Court for Tryall.
 Mills v Stroup, Cond to next Court for Tryall.
 v Wheat, Cond to next Court for Tryall.
 Carpenter v Bailey, Cond to next Court & Frederick Lamb
 Enters S B.
 Caldwell v Taylor, Dismissed.
 Graham v M^cDonald, Cond to next Court for Tryall.
 v the same, Contind to next Court for Tryall.
 Huston v Saylor, Cond to Sep^r for Tryall.
 Manly v Rodgers, Cond.
 Lamb v Bailey, Dismissed at Plts request.
 Huff v Bailey, Dismissed at Plts request.
 Wall v Miller, Cond.
 Tomlinson v Mason, Dismissed at Plts request.
 Roney v Smyth Attachment,
 M^cGee v Russell, Cond.
 Hawkins v Wheat, Cond.
 v Roney, Attachment.
 Davidson v Wolf, Cond.
- (71) Ordered that Ebenezer Zane Take a List of the tithables
 from the Mouth of Whelan to the forks of said Creek ; that Silas
 Hedges take a List of Capt Mitchells Compy ; That James
 Miller take a List of Capt Ogles Compy ; that George Mc-
 Colloch take a List of Leflers Compy . That Zachariah Spriggs
 take a List of Englishes Compy ; That James Gillispie take a
 List of Ellis Compy ; That James Caldwell take a List of Wil-

liamsons Compy ; That John Williamson take a List of Philips Compy : That Charles Wells take a List of Gillilands Compy ;

Appearances.

Graham v Hannah, Con^d.

Whitsell v Biggs, Dismist at Plts request.

Ward v Waller, Dismissed at Plts request.

v The Same, Dismist at Plts request.

v the same, dismissed at Plts request.

v the same, dismissed at Plts request.

Hawkins v Geither, Cond.

Bower v Geither, Cond.

Sharp v Summers, Alias.

Russell v Gillespie, Cond.

Russell v Gillespie, Cond.

Lamb v Barr, Dismissed at Plts request.

Attachments.

Bolin v Dolan, Dismissed.

State & Gillespie v Virgin, Dismissed.

Gillespie v Virgin, Dismissed.

(72) Ordered that Ann Brickell, Daughter of George Brickell, be Bound Unto Edward Robinson According to Law.

The Court is of Opinion that the Court house is Completed by Isaac Taylor, & that his Bond for that purpose be Made Void.

On the Motion of Peter Keller, Ordered that his mark a Crop of the Right Ear & Slitt in the Left Ear be recorded.

On the Motion of Aron Delong, ordered that his Mark a Cropp off the Right Ear and an Under Slope in the Left Ear be recorded.

On the Motion of W^m Scott, Ordered that his mark a Crop off the Near Ear and a Swallow Fork in the off Ear be recorded.

On the Motion of Jacob Keller, Ordered that his mark a swallow fork in the near Ear & a half Crop in the Upper side of the Off Ear.

Dewitt v Garrison, Ordered that this Action Lie Over Untill Next Court & that the Jury already Sworn do appear at the Court House the first day of Next Court to try the same Cause.

- (73) Hawkins v Wheat. The Plt Appeared, the Deft failing to Appear though Solemnly Called, Ordered that the Sheriff Summons a Jury Immediately to appear to Enquire the same. Whereupon James Hannah, Aron Delong, Benjamin Biggs, Jun^r, James Garrison, W^m Lamb, Ezekiel Dewitt, Robert French, James Moore, Isaac Taylor, James Andrew, Zephaniah Dunn & Andrew Moore, who being duly Elected and Sworn do say that they Find for the Deft

BENJ^s BIGGS, FORMAN

Ordered that this Court be Adjourned Untill Court in Course
SOLOMON HEDGES

- (74) At a Call Court held for the Examination of Edward Chapman for Passing Money Supposed to be Counterfeit :

Present, Solomon Hedges, Silas Hedges, Zachariah Sprigg, James Caldwell, George M^cColloch, James Miller, & James Gillespie, Gent,

it is the Opinion of this Court that the said Edward Chapman, Now a Prisoner at the Barr, be Delivered to the Sheriff to Go to Goal, Unless he Can Give Security to appear at Next Grand jury Court

SOLOMON HEDGES

- (76) at a Court held for Ohio County on Monday the 7th day of August 1780.

Present, Solomon Hedges, Charles Wells, Zachariah Sprigg, James Miller, James Gillispie & John Williamson, Gent.

Commonwealth v Samuel Bruce ; the Constable returns a Mitinus with the Body of sd Samuel ; it appears by the Mitimus he was Committed on Supposition of stealing of a Bell, the property of James Dornan, of the Value of Nine pounds. The Court after hearing the Witnesses Examined is of Opinion that the sd Bruce is guilty of stealing sd bell & that the Sheriff take the sd Samuel Bruce and Give him Twenty-five Lashes on his Bare Back.

Certificate of a stray Horse taken up by Samuel Buskirk returned to Court & O.R.

| | | |
|------------|---|---|
| Taylor | } | Ordered that a Didimus Issue to take the Examination of David Frame, For Plt. |
| v | | |
| Williamson | | |

English } Ordered that a Didimus Issue to take the Ex-
 v } amination of John Dickeson, for Plt.
 Curry }

Crow } Ordered that a Didimus Issue to Examine the
 v } Plts Evidence.
 Handly }

Wall v Miller, Debt ; Judm^t Confessed for Nineteen Pounds
 Four Shillings & Costs.

Miller v Hawkins, Dismissed at Plts request.

Hawkins v Miller, Dismissed at Plts request.

Ordered that Alexander Bowling do Act as Constable for the
 Ensuing year in the room of Harry Martin.

(77) James Gillespie, Gent, has returned his List of Tithables.

James Caldwell, Gent, has returned his List of Tithables.

Present Ebenezer Zane, Gent.

Whereas Rawley Martin, an Orphan Boy, being Formerly
 Bound to Harry Martin, is Brought to Court, it being supposed
 that the sd boy was Ill Used. After hearing the Evidence the
 Court is of opinion that the Boy be taken from sd Martin and
 Bound Unto Jacob Reager, to Learn the Art & Mistry of a
 Blacksmith, to be Bound According to Law. the Boy is Six-
 teen years of Age the First day of Last April.

Certificate of a Stray mare taken up by Thomas Stephenson
 is returned to Court & O.R.

Carpenter v Bailey, Dismissed at Plt^s Request.

Ordered that this Court be adjourned For three Quarters of
 an hour.

The Court Met According to Adjournment.

Present, Solomon Hedges, E^d Robeson, John Williamson,
 Samuel McColloch, James Gillespie, James Miller, Gent.

Admn is Granted Unto Geo Dement on the Estate of Joseph
 Black, Deceased, he Complying with the Law ; whereupon sd
 Geo : Came into Court and Gave Jesse Dement his Surety.

(78) Ordered that John Williamson, Robt Taylor, James Cald-
 well & John Lane, or any of them, being First Sworn, do ap-
 praise the Estate of Joseph Black, Deceased, & make return to
 Next Court.

Isaac Taylor Came into Court & took the Oath of Deputy
 Sheriff.

Cha^s Wells, Gent, returned his List of Tithables. Caldwell v Martin, Slander; the Defendant says the Plt is Perjured and he Can Prove it; therefore he Pleads Justification. Ordered that the Sheriff Summons a Jury to Attend Immediately, whereupon Annaniah Davis, Fred Lamb, James McCoy, John Harris, James Hannah, Aaron Delong, Sen^r, Derrick Hogland, W^m Logan, Cha^s Hedges, And^w Zane, Andrew Fouts & John Nichols, Being Duly Elected & Sworn, do say that the Find the Plaintiff Guilty of False Swearing and Judgment on motion.

ANNANIAH DAVIS, Forman.

Ordered that James Gillespie Jun^r, Harry Martin, John Baker, Charles Tuel, Each be Allowed for One Days Attendance in this Action.

Ordered that Thos Pritchard be Allowed For Forty Miles traveling to Court & the same home & for one Days attendance at Court.

- (79) Ordered that a Licence be Granted Unto David English to Keep an Ordinary at his house, he Complying with the Law. Whereupon s^d David Came into Court & Gave W^m Hawkins as his Surety.

Sharp v Summers, Jas. Caldwell, S.B.

Dewitt v Garrison, Dismissed at Plts request, it being agreed by the Parties.

Scott v Caldwell, Ordered that James Marshall & Tho^s Urie do Act as Arbitrators in this Action & their Judgment to be Finall.

Ordered that Isaac Taylor & John Nichols Each be Allowed for four days Attendance as witnesses in this Action.

Ordered that this Court be Adjourned Untill Eight OClock tomorrow Morning

E^v ROBINSON

- (80) The Court Met According to adjournment. Present, Ed Robinson, James Miller, James Gillespie & John Williamson, Gent. Present Solomon Hedges, Gent.

Scott v Caldwell, Cond.

Miller v Cox, Do.

v Geo & Mary Sparks, Cond.

Buskirk v Barber, Cond.
English v Curry, Do.
Taylor v Williamson, Do.
Carpenter v Rogers, Do.
Huston v Sayler, Do.
Crow v Handly, Do.
Cox v Cane, Do.
M^cColloch v Sutherland, Do.
Davis v French, Do.
Cox v Mummy, Do.
Smyth v Curry, Dismissed.
Mills v Wheat, Cond to Oct^r.
 v Stroup, Cond.
Carpenter v Bailey, Dismissed.
Graham v M^cDonald, Cond.
 v the same, Cond.

References

Manly v Rogers, Cond.
M^cGee v Russell, Cond.
Hawkins v Wheat, Dismissed.
Davidson v Wolf, Judgment for £56 & Costs.
Hawkins v Geither, Con^d.
Bower v Geither, Cond.
Russell v Gillespie, Cond.

Appearances.

Hawkins v Miller, Agreed.
Miller v Hawkins, Agreed.
Dunn v Taylor, Cond.
Bailey v Grooms, Alias.
Bailey v Bailey, Agreed.
Sprigg v Taylor, Agreed.
Bailey v Bailey, Agreed.
Gilliland v Gilliland, Alias.
Lutes v Miller, Alias.
 v the Same, Alias.
Nichols v M^cCaley, Cond.
Scott v Ryley, Alias.

Allias Capias

Sharp v Summers, Cond.

Attachments.

Roney v Smyth, Cond.

Hawkins v Roney, Cond.

Caldwell v Martin, Ordered that Joseph Wells & Isaac Ellis be Allowed Each 1 Days Attendance as Witness in this Action.

(81) Caldwell v Martin, Ordered that this Action be Continued to next Court for a Rehearing.

Ordered that David McClure be Appointed Full Clerk of this Court in the Room of James McMechen, who we Understand is out of this State this two Years, he was Sworn in Accordingly.

Ordered that the Sheriff Advertise the Goods taken in possession of Edward Chapman, a Late Prisoner, for sale the first Day of Next Court, in Order to Defray the Expenses incurred on acct of Trying and securing s^d Chapman

Ordered that the Sheriff advertise the Goods taken in possession of David Gamble, a Late prisoner, For Sale on Monday the first Day of Next Court toward Defraying the Expenses incurred by said Gamble.

Certificate of a stray Horse taken up by Robert McGuire is returned to Court & O R.

Andrew Lane Produced a Certificate that he had killed three wolves, to be Allowed him at the Laying of Next County Levy.

(82) Graham v Hanna, Case: dam. £300. Ordered that the Sheriff Summons a Jury to Enquire of this Cause Immediately. Whereupon Jesse Dement, John Nichols, Joseph Wells, George Dement, David English, Charles Tuel, And^w Robinson, James Parks, Andrew Zane, Cornelius McEntire, John Caldwell & Charles Hedges, who being Duly Elected & Sworn, do say the assess the Plt Damage to One hundred Dollars & Costs.

Ordered that Nicholas Rogers be allowed for two Days attendance in this Action.

(83) Ordered that the Ordinary Keepers in this County Sell at the Following Rates — viz :

| | Dollars ¹ |
|--------------------------------|----------------------|
| For Half pint whiskey, | 6 do. |
| For Do with Sugar, | 8 do. |
| For Breakfast or Supper, | 6 do. |
| For Dinner, | 10 do. |
| For Lodging with Clean sheets, | 3 do. |
| For 1 Horse to hay 24 Hours | 6 do. |
| For pasturage, Do, | 3 do. |
| For 1 Gallon of Corn, | 5 do. |
| For 1 Do Oats, | 4 do. |
| For 1 Qt Strong Beer, | 4 do. |

Ordered that this Court be adjourned Untill Court in Course

JOHN WILLIAMSON

[The next term of this Court was held on September 4, 1780, but as Yohogania County had held its last term of court on August 28 of that year, and no Virginia Court was ever held afterward within the limits of Pennsylvania, our transcript of these court records will here end. Yet the Ohio County Court, removed from Black's Cabin to Wheeling in 1797, continues in existence to this day, and its ancient records are now in the custody of Mr. RICHARD ROBERTSON, the present Clerk of that Court, by whose kind permission we have been enabled to make our copy. This series of papers disclosing the transactions of these old Virginia Courts within the limits of Pennsylvania, will be followed in the next issue of the ANNALS OF THE CARNEGIE MUSEUM by a transcript of the Deed Book of the old court held for the District of West Augusta at Fort Dunmore, 1775-1776, before the division of that district into the three counties, Ohio, Yohogania, and Monongalia.—B. C.]

¹ For the depreciation of the currency of this date, see Vol. 11, p. 210, of these ANNALS.

II. THE TROPIDOLEPTUS FAUNA AT CANANDAIGUA LAKE, NEW YORK, WITH THE ONTOGENY OF TWENTY SPECIES.

BY PERCY E. RAYMOND.

GENERAL INTRODUCTION.

The present paper is composed of two distinct parts, the first part being of a biological nature, and representing the results of work done at the Yale University Museum under the late Professor Beecher ; and the second a faunal paper, prepared under the direction of Professor Williams, also at Yale.

An abstract of the first part of the paper giving the more general results in condensed form, was published in the *American Journal of Science*, Vol. XVII, April, 1904. The details are now presented, illustrated by about forty figures and one plate in addition to those which accompanied the abstract, and several species are here discussed, which were not touched upon in the previous paper.

I wish to acknowledge my indebtedness to that great palæontologist, Dr. C. E. Beecher, not only for his guidance in the preparation of this paper, but for his help and continual inspiration for work in the field of research. The figures are the work of Mr. Sidney Prentice, draughtsman in the Section of Paleontology at the Carnegie Museum. Most of them are from camera lucida sketches. The plates are from photographs taken by Professor Beecher and the writer.

A set of the specimens on which the first part of the paper is based has been deposited by the writer in the Carnegie Museum, and figures 1-3, 5-12, 14, 15, 24, 26-29, 33, 34, 42-45, 47-48 are drawn from individuals in this collection. The series represented in the plates are the property of the Yale University Museum.

PART I. ON THE DEVELOPMENTAL CHANGES OF SOME OF THE COMMON DEVONIAN BRACHIOPODS.

INTRODUCTION.

Certain layers of impure, clayey limestone from the Moscow (Hamilton) shales in a ravine near Canandaigua Lake, N. Y., were found

by Dr. John M. Clarke to contain fossils, whose shells had been so completely replaced by silica, that, when the rock was etched in acid, the shells were left in as perfect condition as they were when buried in the limey clay of their native sea-bottom. A large quantity of the material was obtained by Professor C. E. Beecher and through his kindness the writer was given an opportunity to study a part of it. About sixty-five pounds of this rock was treated with hydrochloric acid and the shells separated by washing from the clay which remained after the calcium carbonate had been removed. About fifteen thousand nearly perfect specimens were selected and a much greater quantity of fragmentary material discarded. Nearly all classes of invertebrate animals were represented in this collection, but the brachiopods were most numerous, composing fully two-thirds of the total number of individuals. There are as many as thirty-five hundred specimens of one species (*Chonetes scitulus*). Next in abundance to the brachiopods were the Bryozoa, then the Crustacea, worm tubes, Pelycypoda, Gastropoda, Anthozoa, and Cephalopoda in the order named. The Echinoderms are represented only by crinoid columns. There were also a few fish scales and sponge spicules found. Chitinous shells of the *Lingula* type do not appear to have been preserved and some of the Dimyarian bivalves occur only as casts.

The majority of the shells are white, but some are dark gray to black and the trilobite tests are light to dark brown. The color seems to be fairly uniform for all the individuals of the same species. For instance, there are two species of *Monotrypa*, and all the individuals of both species are black, while most of the Bryozoa are light colored. But in the case of *Chonetes mucronatus*, whereas most of the specimens are dark, a few are light.

The state of preservation of the fossils in this material is remarkable, even the finest details being retained, which shows conclusively that the shells were not subjected to any rough wave action after the death of the animal. The graceful fronds of the Fenestellidæ are obtained as they grew, and the delicate spines of the Productidæ and the spini-form extensions of the cardinal angles of the young Stropheodontas are perfectly preserved. Unfortunately the brachial loops and spires are not so well preserved, though many specimens of *Eunella* show a large part of the loop and in one young specimen it is entire. Many specimens of *Tropidoleptus* retain the delicate median septum and the crura but the full loop was not observed.

Perfect specimens of the little Ostracods of the genera *Halliella* and *Kirkbya*, whose shells are merely a fine network, were obtained, and also many of the Rhombopora-like Bryozoa covered with minute spinules.

The pelecypods, which are nearly all immature individuals, are excellently preserved, and many of them retain the prodissoconch.

The advantage of this method of collecting is shown in the great number of specimens of supposedly rare species obtained. *Pholidops hamiltonia*, which is rare in ordinary collections, is extremely abundant in this material, only one species being more common. *Pholidops oblata*, of which not more than a dozen specimens have been obtained from other localities, has been obtained by the hundreds. *Ascodictyon stellatum*, *Autodetus lindstræmi*, and the Ostracods, which are rarely found in any quantities, are here very common.

The whole fauna consists of about 115 species so far identified and 10 or 12 species whose specific identity is uncertain, some of them probably new. The fauna is distributed as follows, Crustacea: Trilobita, 5 species; Ostracoda, 11 species; Cephalopoda, 1 species; Gastropoda, 8 species; Pteropoda, 3 species; Pelecypoda, 16 species; Brachiopoda, 38 species; Bryozoa, 18 species; Vermes, 6 species; Anthozoa, 5 species.

A large proportion of the individuals of the Brachiopoda are in immature stages, many of them being less than one millimeter in length and there are specimens showing all gradations in size up to the adult, and in many cases, to the senile conditions. Series showing all these stages were picked out whenever possible, and carefully studied to ascertain what changes took place during the lives of the individuals of the various species.

The pioneer work of this sort was done by Beecher and Clarke on material obtained from Waldron, Indiana. In the memoir which they published giving the result of this work, the development of 25 species, belonging to 18 genera, was described. Later work by Beecher, Schuchert, and Cumings has added a full description of several more. Among the fossil Brachiopoda, two genera of the Rhynchonellidæ, three of the Atrypidæ, two of the Spiriferidæ, three of the Athyridæ, one of the Cranidæ, one of the Eichwaldidæ, four of the Strophomenidæ, four of the Orthidæ, and one of the Porambonitidæ, have been studied in this way up to the present time.

In the present paper the full series of changes are described for twenty other species and notes are made on four more. In this

list there are fifteen genera, eleven of which are not represented by the work previously done. These genera belong to the families Centronellidæ (*Trigleria*), Terebratulidæ (*Eunella*), Terebratulidæ (*Tropidoleptus*), Spiriferidæ (*Cyrtina*, *Delthyris*), Cranidæ (*Pholidops*, *Craniella*), Strophomenidæ (*Stropheodonta*, *Pholidostrophia*), and Productidæ (*Chonetes*, *Strophalosia*). The genera *Crania*, *Rhipidomella*, *Spirifer* and *Orthothetes* are here represented by middle Devonian species, while the previous work was done on Silurian species, and interesting points may be obtained by comparison.

The following list shows which of the brachiopods that occur in this material furnished series suitable for study.

Camarotoechia congregata (Conrad). Two specimens, both adults.

C. horsfordi Hall. One specimen, an adult.

C. sappho Hall. One specimen, an adult.

Trigleria lepida Hall. Specimens few, but most of the growth stages are represented.

Eunella lincklaeni Hall. Complete series.

Tropidoleptus carinatus (Conrad). Abundant both in young and mature stages.

Atrypa reticularis (Linnaeus). One specimen.

Cyrtina hamiltonensis Hall. Full series.

Spirifer mucronatus Conrad. Full series.

S. audaculus (Conrad). Some young specimens but not a full series.

S. granulosus (Conrad). Few specimens, all adults.

Delthyris consobrinus (d'Orbigny). Full series.

D. sculptilis Hall. Rare, all adults.

Reticularia fimbriata (Conrad). Rare, adults only.

Ambocælia umbonata (Conrad). A few very small specimens; adults not present.

Nucleospira concinna Hall. Rare, adults only.

Athyris spiriferoides (Eaton). Rare, adults only.

Pholidops oblata Hall. Common, full series.

P. hamiltoniae Hall. Abundant. Full series.

Crania crenistriata Hall. Rare. Incomplete series.

Craniella hamiltoniae Hall. Fairly complete series.

Stropheodonta concava Hall. Rare. Later neanic and adult stages only represented.

S. demissa (Conrad). Adults only, rare.

S. inæquistriata (Conrad). Common. Full series.

- S. junia* Hall. Rare, one adult only.
S. perplana (Conrad). Common. Full series.
Pholidostrophia iowaënsis (Owen). Full series.
Orthothetes chemungensis (Conrad). Common, full series.
O. chemungensis arctistriatus Hall. Full series.
O. bellulus Clarke. Full series.
Chonetes coronatus (Conrad). Full series.
Chonetes mucronatus Hall. Full series.
C. scitulus Hall. Full series.
C. robustus Raymond. Full series.
Strophalosia truncata (Hall). Full series.
Productella spinulicosta Hall. Rare, all adults.
Rhipidomella penelope Hall. Rare, adults only.
R. vanuxemi Hall. Common, full series.

***Craniella hamiltoniæ* Hall.**

Hall, Pal. N. Y., IV, 1867, p. 27, pl. 3, figs. 17-23.

***Crania crenistriata* Hall.**

Hall, Pal. N. Y., IV, 1867, p. 28, pl. 3, figs. 13-16.

There are, among the shells from Canandaigua Lake, about forty dorsal valves of *Craniella hamiltoniæ*, the smallest of which is 3 mm. long and 3.6 mm. wide. The largest is 15.2 mm. \times 19 mm. One specimen retains both valves, and there is a single imperfect ventral valve attached to a specimen of *Tropidoleptus*.

Nearly half of the specimens show by their strongly corrugated surfaces that they were attached during life to a *Tropidoleptus*, while others show a variety of finer markings, or are entirely smooth. The young shells are, as a rule, more conical than the adults. The smallest shell has a height of 1.66 mm. or .55 of its length. Another, 5 mm. long, has a height index of .63. A specimen 6 mm. long has .52 for this index; one 7.5 mm. long has .35; one 11 mm. in length has .27 and the largest individual has .26. A few of the small ones are, however, quite depressed convex. One specimen, 4.16 mm. long has a height index of only .32, while, on the other hand, the index of a specimen 12.33 mm. long is .44.

The muscle scars show well in the dorsal valve, but add nothing to what is known of them. A specimen 3.6 mm. long and 3.86 mm. wide has the scars in the same relative position as in the adult, show-

ing that a constant and uniform migration of the posterior pair of muscles must take place. One specimen shows a sort of cardinal area on the posterior margin, which is, in this individual, nearly straight.

There is an incomplete series of nine dorsal valves of *Crania crenistriata*. They range in size from 2.66×3.33 mm. to 12.5×13.5 mm. It shows nothing of interest beyond the fact that there is a non-plicate nepionic stage, whose shell measures 1.46 mm. in length and 1.66 mm. in width, on the smallest specimen. There are 25 striae on this individual, all of which begin at the same time at the boundary of the nepionic shell.

Pholidops hamiltoniæ Hall. (Plate I.)

Hall, Pal. N. Y., IV, 1867, p. 32, pl. 3, figs. 6-9.

There are, in the collections, about 1,500 specimens of this species, all but two of them separate valves. Next to *Chonetes scitulus*, this is the most abundant species in the material. The smallest specimen is .54 mm. in length and .46 mm. in width; the largest is 3.93 mm. long and 3.20 mm. in width.

Nepionic Shell. — On the beaks of the dorsal valves of some of the specimens the nepionic shells are preserved. At this stage the shell is wider than long, oval, and with a hinge line only slightly curved. The shell is convex and smooth. The largest shell of this stage seen is .15 mm. long and .176 mm. wide. The smallest is $.13 \times .15$ mm.

Changes During Development.

After the nepionic stage, growth of the shell takes place posterior as well as anterior to the beak. The shell becomes attached to some foreign object by the cementation of the ventral umbo. The amount of surface involved in this attachment is extremely small, so the symmetrical development of the shell is in no way prevented. On one specimen the scar is roughly oval, .13 mm. long and .11 mm. wide, and this is about the average size.

The first change, in outline, from the transversely oval shell of the nepionic stage is when the shell becomes elongate oval in the early neanic stages. At a length of .50 to .75 mm. it assumes the form which it retains throughout life. The beak is situated about one quarter (.21 to .28) of the length of the shell from the posterior margin, and the shell is broadest at the point.

The index of the nepionic shell is about 1.10 to 1.15; of the neanic .79 to .95, and of the adult .76 to .90. The average for ten specimens in neanic stages is .86, and of a similar number of adults, .83.

The shell substance is impunctate.

Muscle Scars. — The muscular area is roughly shield-shaped with the broad end directed backward. The front end is about the middle of the valve. The area is very small, as compared with the size of the valves. In a specimen 3.93 mm. long and 3.20 mm. wide the muscular area is 1.06 mm. long and .86 mm. wide. In a smaller specimen, 1.5×1.3 mm., the area is $.5 \times .5$ mm.

In both valves there are narrow transverse scars on the anterior and posterior borders of the area. In the ventral valve, behind the anterior transverse scar, are two large oval adductors. Their anterior ends nearly meet, and the posterior ends are widely separated. Back of them, at the corners of the shield, are two small round scars, and there is a double scar on the median line.

In the dorsal valve the anterior adductor scars are narrow and parallel. Behind them are two smaller scars and between them a median scar.

Pholidops oblata Hall. (Plate II.)

Hall, Pal. N. Y., IV., 1867, p. 414, pl. 3, fig. 10.

Of this species there are about 200 specimens in the collection. The smallest is 1.23 mm. long and 1 mm. wide. The largest is 7.8 mm. long and 7 mm. wide. A specimen of this species described by Hall is about twice the size of the largest shell in our collection. It is 15.5 mm. long and 14 mm. wide.

Nepionic Shell. — As in *P. hamiltoniæ* the nepionic shell is oval, broader than long, convex, and with a slightly curved hinge line. The dimensions of the smallest shell of this stage are $.18 \times .20$ mm.; or the largest $.25 \times .27$ mm. (Fig. 1).

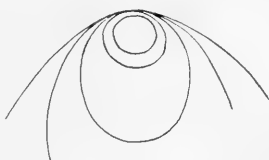


FIG. 1. *Pholidops oblata* Hall. Nepionic and early neanic stages, drawn from a dorsal beak. They might be termed the *Crania* and *Pholidops hamiltoniæ* stages. $\times 30$.

Changes During Development.

After the nepionic stage the growth is more rapid in front than at the sides and an elongate oval form is produced when the shell is about .6 mm. long. The beak is then marginal and the greatest

width is about midway between the anterior and posterior margins. In older shells the interior retains this oval form, while the beaks of both valves project posteriorly, giving the exterior of the shell a roughly triangular appearance. The ventral beak is often more extended than that of the dorsal valve.

The index of the nepionic shell is from 1.08 to 1.16. Of the neanic shells, from .96 to .65. Among the adults there are both wide and narrow forms. In the narrow ones, as seen from the inside, the periphery is elongate oval, while in the wide forms, it is circular. In general the index rises as the length increases, coming up from .76 in a shell 2 mm. long to .90 in one 7.8 mm. long. In no stage is there any evidence of a pedicle opening.

Muscle Scars.—The muscular areas are shield shaped, with the points directed forwards. The broad posterior side is close to the posterior margins of the shell, and the anterior point reaches about midway to the front.

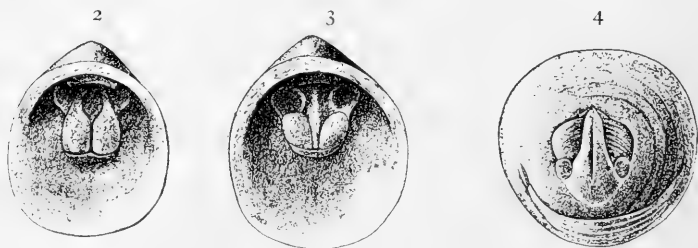


FIG. 2. *Pholidops oblata* Hall. Ventral valve, showing anterior and posterior unpaired scars, anterior and posterior paired scars, and median scar. $\times 4$.

FIG. 3. The same species. Dorsal valve, showing the corresponding muscles. $\times 4$.

Both figures from specimens in the writer's collection.

FIG. 4. *Trematis millepuncta* Hall. Interior of dorsal valve after Hall and Clarke for comparison with Fig. 3. Copied from Fig. 4. Pl. IV G, Pal. N. Y., Vol. 8, pt. 1.

In the ventral valve, there is a narrow transverse scar forming the front of the shield. In some specimens this seems to be made up of two scars, one on either side of the median line of the shell. Behind this are two large oval scars, situated obliquely, with their anterior ends nearly, but not quite, meeting. Behind these, at the posterior corners of the shield, are two smaller scars which are roughly triangular in some specimens and nearly round in others. Between these is an elongate scar, divided into two parts along the median line. On

the posterior end of the shield is a narrow, crescent-shaped, transverse scar (Fig. 2).

In the dorsal valve the arrangement is much the same, except that the anterior pair of scars, instead of being oval and oblique, are elongate and run back to the posterior transverse scar. The scars of the posterior pair are situated outside of the narrow part of the anterior scars, and are slightly smaller than the corresponding scars in the opposite valve (Fig. 3).

The main scars probably are analogous to the anterior and posterior oculusors of *Crania*, and the posterior scar may have the same functions as the umbonal scar in *Lingula*. A very similar arrangement of scars is seen in *Trematis* (Fig. 4).

***Stropheodonta inaequistriata* Conrad.** (Plate III, Rows 3, 4, 5.)

Conrad, Pal. N. Y., 1867, p. 93, pl. 12, figs. 6-8.

In the Canandaigua Lake material there are about four hundred well preserved pedicle valves, and about one-half as many dorsal valves of this species. The dorsal valves are not so well preserved as the ventral valves, as the anterior part is usually broken away. Only about twenty specimens which retain both valves were obtained, and these were nearly all adults.

The smallest specimen in the collection is 1.2 mm. long and 2.2 mm. wide. The largest is 16 mm. long and 27 mm. wide. All gradations between the two are shown. Hall (Pal. N. Y., Vol. IV, plates 15 and 18) figures several specimens, all adult or senile individuals from the Corniferous and Hamilton. The smallest is 12×18 mm. and the largest 22×29 mm. The specimen figured on Plate 18, fig. 2*k*, Pal. N. Y., Vol. 4, shows the muscle scars in the ventral valve of a senile individual, and fig. 10, pl. 15, shows the muscle scars of the adult. Fig. 11 on the same plate shows well the interior of the dorsal valve, with the adductor scars (which are not represented as divided into two pairs) and the strongly raised curved ridges in front of the scars of the senile individual. Fig. 2*h*, pl. 18, shows the muscle scars and ridges of a younger specimen, probably in the early ephebic stage. The species is placed by Hall and Clarke with *S. arcuata* Hall, *S. cayuta* Hall and *S. variabilis* Calvin, in the division Douvillina of Ehlert.

Nepionic Stage. — In the nepionic stage the shell is oval in outline and wider than long. Both valves are convex, though the dorsal valve becomes flat in front in some specimens. In the dorsal valve

there is a narrow fold which extends about half way to the front. Otherwise the shell is smooth. The width at the hinge is a little less than the width below. The length of an average specimen is .42 mm. and the width .54 mm.

Changes During Development.

Outline. — Immediately after the nepionic stage the width at the hinge becomes greater than the width below and remains so throughout all succeeding stages. The cardinal extremities are most alate during the adolescent period and all immature forms are characterized, when perfect, by very long hinge lines. In the senile state, the cardinal angles are rounded a little, but the width at the hinge is still greater than the width below. From the early neanic through the adult stages the index increases gradually, while in senile specimens the anterior growth lowers it again. It varies from 1.25 to 1.50 in adolescent individuals and from 1.50 to 1.75 in adults. In one senile specimen it falls as low as 1.19.

Convexity of Valves. — In the nepionic stage both valves are convex, but when a length of about .50 mm. is reached, the dorsal valve becomes concave in front and follows very closely the contour of the other valve throughout the succeeding stages. Shells from 1 to 6 mm. long are very slightly convex, sometimes almost flat, but as they grow older, the convexity increases, until, in the gerontic stage, they are almost hemispherical.

Striæ. — The smallest specimen showing striæ is 1.1 mm. long and 1.8 mm. wide. It is a ventral valve and has nine strong striæ, between which are extremely fine striæ which can hardly be made out. Five of the prominent striæ extend back to the line bounding the nepionic shell. One of these is on the median line of the valve and has a pair on either side of it. Between each pair of these striæ a striation is implanted near the anterior margin of the shell (Fig. 5).



FIG. 5. *Strophodontia inaequistriata* (Conrad). Ventral valve, showing the primary striæ. $\times 8$.

After this stage the number of striæ increases rapidly, by implantation. An adult has from 30 to 60 prominent striæ with bundles of three to five smaller striæ between them. They are not obliterated in the senile stages, but increase in number with the increase of the shell in size. There are, in that stage, from 50 to 80 of the strong striæ.

Muscle Scars. — In young stages the muscle scars are so faint that they are almost indistinguishable. The smallest ventral valve, in which anything definite can be made out, is 4×4 mm. In it the diductors have oval, somewhat widely separated, scars, between which are the two small adductors, one on either side of the median line. The diductors are bounded posteriorly by two ridges which make a wide angle with each other. The adductor scars have faint ridges on either side and another ridge between them. In a little later stage these three ridges around the adductors become sharp and distinct. The median one runs back nearly to the beak, while the outer ones remain short, sharp and rather high, curving outward. In the later neanic stages these ridges arch over and join the ridges which bound the diductors (Fig. 6). The two ridges which bound the posterior



FIG. 6. *Strophodontia inaequistriata* (Conrad). Ventral muscle area and ridges of an individual in later neanic or epehebic stages. $\times 2$.

FIG. 7. The same species. The corresponding area in ventral valve of a specimen in later epehebic or gerontic stages. $\times 2$.

FIG. 8. The same species. Interior of the dorsal valve of a young specimen, showing cardinal process and ridges in front of it. $\times 2$.

FIG. 9. The same species. Interior of the dorsal valve of an adult, showing the two pairs of adductor muscle scars and the brachial ridges in front of them. $\times 2$.

Figs. 6-9 are from specimens in the writer's collection.

borders of the diductor impressions send off processes a short distance in front of the hinge which turn inward and run parallel for a short distance. They rise sharply from the floor of the valve and overhang on the side toward the median line. In the later neanic stages the whole extent of the diductor impressions is bordered by a long sharp ridge which is later resorbed.

During the adult stage, the parallel portions of the two ridges which bound the diductors are extended and strengthened, and the divergent portion is resorbed. The median ridge becomes stronger and rounded, the two sharp ridges which separated the adductors from the diductors disappear, and an almost square muscle scar is produced. In this scar the diductors are very plain, and the adductors are narrow and situated somewhat posteriorly. Behind these is a median pedicle muscle (Fig. 7).

In the brachial valve of some specimens the adductor muscle scars are well defined and in others they are very faint. They are usually bounded by a low ridge. The outer pair, the posterior adductors, make up most of the scar. They are small, roughly triangular, and situated close to the front of the cardinal process. The anteriors are narrow, and are situated on a platform between and slightly above the level of the posteriors (Fig. 9).

Between the scars, on the median line, is a low, short septum which is hardly elevated above the surface of the shell in young specimens but becomes prominent in adults. On either side of it is a low ridge which extends back nearly to the base of the cardinal process. In the adult the portion of the ridges in front of the muscle scars becomes high and incurved, and may function as a support for the brachia. These ridges are short, and their anterior ends are not half way to the front of the valve (Figs. 8 and 9).

They appear to be homologous with similar ridges in *Chonetes scitulus*, which certainly are connected with the brachia. The structure of the muscle scars and ridges in this species should be compared with that of the dorsal valve of *S. concava* (Fig. 16).

Hinge Structure. — The young specimens do not preserve the hinge structure, but in adult and senile stages, the deltidium is present and covers the deltyrium entirely. The pedicle opening is forced back into the beak. In a specimen 7 mm. long and 11.8 mm. wide the deltidium is continued into a short, exsert pedicle tube. The aperture at the apex of this tube is about .05 mm. in diameter, which is fully twice the diameter in some of the adult and gerontic specimens examined.

Crenulations. — In the smallest specimen (3 mm. wide) which showed any trace of crenulations, .66 mm. on each side of the middle point of the area was marked by faint depressions, about 6 on each side. Thus about .44 of the area was crenulated. A specimen 4.7 mm. wide had .43 of its hinge width crenulated. A specimen 6 mm. wide has .66 of its width crenulated. Another specimen, 12 mm. wide, had .71 of its width crenulated. A specimen 24 mm. on the hinge line, had crenulations which extended .56 of the distance between the cardinal extremities. A senile individual had crenulations covering .57 of the hinge width. Thus it is seen that a greater proportion of the hinge is crenulated during the later neanic and adult stages than during the early adolescent or senile periods.

Cardinal Process. — The cardinal process is deeply bifurcate in the youngest specimens showing it. In older stages each part is again divided by a sharp depression which becomes deeper as development goes on. On each side of the process are the dental lamellæ, which, in young specimens, are sharp and thin, but later become low and rounded. In some adults they are hardly to be distinguished from the two ridges which bound the posterior adductor scars.

The Same Species From Other Localities.

A single specimen from Genesee, N. Y., is smaller than the ones just described. It is 16×19 mm. and has 26 prominent striæ, between which are fascicles of seven or eight small ones. This specimen is quite regularly convex.

There are several specimens from East Bethany in the collection, all of which are small, but show mature characters. The largest specimen is 16×21 mm., and has 60 prominent striæ in front with groups of three or four smaller ones between. The smallest is 8×11.5 mm. and has 23 striæ on the front. An average specimen is 13×20 mm., with 50 prominent striæ on the front, 9 of which extend to the beak. Although the specimens are small they are strongly convex, instead of being moderately convex or nearly flat, as is the immature condition of the specimens from Canandaigua Lake.

***Stropheodonta perplana* Conrad.** (Plate III, Row 1.)

Hall, Pal. N. Y., 1867, pp. 92, 98, pl. 11, fig. 22, pl. 12, figs. 13-15.

There are, in the collection, about 150 nearly perfect specimens belonging to this species. The majority of them are separate valves, more of the ventral than of the dorsal, and, as is the case with *S. inæquistriata*, the pedicle valve is the more perfectly preserved. A few adult individuals retain both valves. The specimens range in size from 1.6×1.8 mm. to 21×24 mm. All stages between these limits are represented. On the beaks of both valves the younger stages are well shown.

A figure showing the deltidium, pedicle opening, and nepionic stage of this species has been published by Beecher (Am. Jour. Sci., 3d series, Vol. XLI, 1891, p. 357, pl. 17, fig. 17). Hall has figured specimens from the Corniferous, Hamilton and Chemung. Of these, the smallest from the Corniferous is 15×19 mm., the largest 37×46 mm. The smallest from the Hamilton is 19×20.5 mm. and the

largest 38×49 mm. From the Chemung the smallest specimen figured measures 33×39 mm., and the largest 42×61 mm.

Protegium. —The protegium is nearly circular, both valves convex, and with arcuate hinge. It measures $.10 \times .10$ mm. in one specimen and $.12 \times .12$ mm. in another.



FIG. 10. *Strophodontia perplana* Conrad. Dorsal valve, showing shell in nepionic stage, the fold, and the origin of the striae. $\times 16$.

FIG. 11. The same species. Outline of the ventral valve, showing the acuminate cardinal extremities. $\times 3$.

FIG. 12. The same species. Interior of ventral valve, to show the diductors and the two pairs of adductor scars. $\times 1$. Compare with Figs. 14 and 17. The specimens are in the writer's collection, now deposited in the Carnegie Museum.

Nepionic Stage. —The shell, in the nepionic stage, is convex in both valves, nearly as long as wide, and with a hinge width about as great as the width below. In the dorsal valve there is a fold which extends nearly to the front of the shell. Otherwise the valves are smooth. The dimensions at this stage are: in one shell, .56 mm. long and .64 mm. wide; in another, $.60 \times .72$ mm. (Fig. 10).

Changes During Development.

Outline. —In early neanic stages, the width of the hinge becomes greater than the width below, and, during all the adolescent period, the shells are strongly alate and the hinge width is frequently two and a half or three times the length of the shell (Fig. 11). In the adult stages the hinge width is still the greatest width of the shell, but the cardinal extremities are not far extended. In one young individual, with a width of 7 mm. on the hinge line, each extremity forms a spinelike extension 1.5 mm. long, thus making up nearly one half the total width. Other specimens 10 mm. wide at the hinge, have alate extremities, each 2 mm. in length. In computing the index, the width below the hinge was taken and it was found that, apart from the extensions of the cardinal angles, there is very little change in form through life. The older shells are a little longer, in proportion to the width, than the young ones. The index, in neanic stages, is about 1.45 to 1.30 mm. and, in the adult, 1.35 to 1.20 mm.

Convexity of Valves. — Immediately at the end of the nepionic stage the dorsal valve becomes slightly concave, and remains concave or flat throughout the remaining stages of its development. The pedicle valve is convex in all stages, but never strongly so, producing a nearly flat shell.

Striæ — Just at the anterior edge of the smooth nepionic shell the striæ begin. They are introduced in pairs on the dorsal valve while the pedicle valve has an unpaired median striation. A shell .75 mm. long and 1 mm. in width has seven striæ on the ventral valve and eight on the dorsal. Before the shell is 1 mm. in length the older, that is, the middle striæ, have bifurcated, and, from that time, the increase of striæ is rapid and new ones are added by both bifurcations and implantation. A shell 1.8 mm. long has 19 striæ. One 2.8 mm. long has 45, one 8 mm. in length has 140, and one 16 mm. long has 200. In neanic stages the extended cardinal angles are smooth, even after the striæ become numerous in front. In adult shells, the striæ cover almost the entire surface. Very fine concentric lines cross the striæ. Near the umbo and occasionally all over the shell, are faint concentric undulations. They are especially strong in young shells and dorsal valves.

Crenulations. — On the smallest shell, in which the hinge is preserved $.2 \times 2.5$ mm., the crenulations extend .6 of the distance from the beak to the cardinal extremity (not an alate shell). On a larger shell, 5.3 mm. wide at the hinge, .8 of the distance is crenulated, and in all individuals larger than that, the crenulations extended the whole width of the shell.

Pedicle Opening. — The material does not illustrate this part of the development well. No very young specimens retaining both valves were found, and the young ventral valves are all broken at the beak. An adolescent individual, 5.6×8.4 mm. shows a flat deltidium, whose limits can hardly be distinguished, and a relatively large pedicle opening just behind the beak. In adult specimens there is a more or less convex deltidium, often not well defined at the sides, and the pedicle opening is very small and pushed forward on to the beak.

Muscle Scars. — The muscle scars of young specimens are not strongly marked in either valve. In the ventral valve of the adult, the diductors leave elongate, flabelliform scars. Between them, lying on either side of the low median septum, are the two long oval scars of the adductors. Diagonal lines divide each scar, marking the limits of the anterior and posterior elements (Fig. 12).

The diductors are bounded behind, and at the sides by two low, pustulose ridges, and the whole interior of the valves outside the scars, is covered with smaller pustules.

In the dorsal valve there are two pairs of adductor scars bounded posteriorly and laterally by ridges, but not well limited in front. The anteriors are situated between the posteriors and are divided from them by faint ridges.

There is, as far as could be seen, very little change in these scars from the young through the adult stages. In the dorsal valve, the ridges, which limit the posterior and lateral sides of the scars, are more divergent in young stages than in the adult, thus producing relatively narrower scars in the adult than in the neanic specimens.

Unfortunately no specimens showing strong gerontic characters have been obtained from this material.

Pholidostrophia iowaensis Owen.

Hall, Pal. N. Y., IV, 1867, p. 104, pl. 18, fig. 1.

In the collection there are about 130 specimens, ranging in size from 1.6×2 mm. to 14×16 mm. Three specimens retain both valves in their proper relations, but the remainder are separate valves. The specimens figured by Hall are adult and gerontic individuals. The smallest is 11.4×14 mm. and the largest 13×17 mm.

Description of Smallest Shell. — The smallest shell in the collection is 1.6×2 mm., semi-elliptical in form, with a width at the hinge greater than the width below. The ventral valve is gently and regularly convex, while the dorsal valve is convex at the beak and concave, nearly flat in front. The surface is smooth on both valves.

Changes During Development.

Outline. — During the neanic stages the cardinal extremities are alate and the hinge width is usually one and one-half to twice the length of the shell. In adults the width at the hinge equals or is a little less than the width below, and the length and width frequently become very nearly equal. The young shells are not, however, so strongly alate as the young of *Strophodontia perplana*, but this is largely due to the accidental removal of the tips of the cardinal extremities. One specimen, a ventral valve, shows three stages of growth, and the spiniform extremities of each are fairly well preserved. Instead of the new growth being added to the whole length of the hinge, these ex-

tremities have been left free so that the first two pairs form spine-like processes, raised slightly above the surface of the shell. The shell, up to the first distinct growth line, has a length of 2.5 mm. and a width of 5 mm. The spines are each 8 mm. long. The second stage is 3×8.6 mm. and each spine is 2.5 mm. long. The shell at the last stage is 6×10 mm. and the spines 2 mm. long. So, if the spiniform extensions were preserved in ordinary specimens, the outline would be very different from that usually seen in this species (Fig. 13).

The index, disregarding the alate cardinal extremities, falls from early neanic to senile stages, the length becoming constantly greater, in relation to the width. The extremes are 1.50 and 1.00 mm. but the average, in neanic specimens is from 1.30 to 1.45 mm. and, in adult and senile individuals from 1.10 to 1.25 mm.

Convexity of Valves. — In all stages, up to the later adult and gerontic, the ventral valve is gently and regularly convex, and the dorsal valve flat or slightly concave. Late in the development, the shells become rather abruptly and strongly deflected in front, which makes the ventral valve very convex in this part and the dorsal valve correspondingly concave. The exterior of the shell remains smooth in all stages except for the strong growth varices, of which there are usually at least two or three, and, in gerontic individuals several, toward the front.

Crenulations on the Hinge. — On a specimen 2×3 mm. the crenulations occupy less than half (.45) of the length of the hinge. Those under that size do not seem to have any crenulations. A larger specimen, 5.6×7.3 mm., has crenulations which occupy a little more than half (.59). In adults the crenulations cover about this same amount. In one specimen it was .58, and in another .64, which was the highest observed.

Pedicle Opening. — In the adult, the pedicle opening is very minute and encroaches upon the beak. The deltidium is perfectly flat and the longitudinal striations on the cardinal area extend across without any break. Occasionally the outline of the deltidium is fairly well marked. In young specimens there is a pedicle tube which projects a little beyond the beak.

Muscle Scars.

Pedicle Valve. — There are two large flabelliform diductor scars and, between them, posteriorly, are the two elongate oval ones of the adductors, one on each side of the low median septum. Each scar is

divided by a diagonal line, into anterior and posterior parts (Fig. 14).

In the dorsal valve are two pairs of adductor scars. On each side of a low rounded median septum is a small oval anterior adductor scar. At the sides and a little posterior are the larger posterior pair. These scars are surrounded by low ridges which are more strongly developed at the back and sides than in front (Fig. 15).

The median septum in this valve is produced for some distance in front of the muscle scars and in the adult and senile specimens is rather high and strong. Beginning just in front of the middle of the

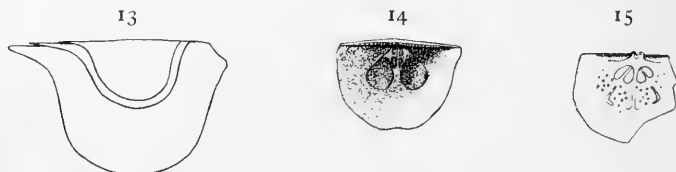


FIG. 13. *Pholidostrophia iowaensis* (Owen), ventral valve showing the acuminate cardinal extremities of young specimens. $\times 3$

FIG. 14. The same species. Interior of ventral valve, to show the adductor and diductor muscle scars. Natural size.

FIG. 15. Interior of dorsal valve of the same species showing the adductor muscles scars and the ridges connected with the brachial impressions. Natural size.

FIG. 13. From a specimen in the Yale University Museum collection. Figs. 14 and 15 from specimens in the writer's collection.

scars, on each side of the septum is a low ridge which curves gently outward and then inward again, turning in rather abruptly as a sort of hook at the anterior end (Fig. 15).

In adults these processes extend about two thirds of the distance to the front of the shell. In the young, they extend somewhat further forward and are more divergent. These ridges correspond, in position, with the brachial ridges of *Chonetes*, *Productus*, etc., and should probably be correlated with those markings.¹

The genus *Pholidostrophia* was suggested by Hall and Clarke to include a section of *Stropheodonta* in which the shells were concavo-con-

¹ Ridges much like these, in *Stropheodonta leblanci* Rouault were described by Célert as belonging to the brachial apparatus. In describing the interior of the dorsal valve of that species he says, "Les empreintes des muscles adducteurs . . . sont très rapprochés de la ligne cardinale et occupent de chaque côté du septum une surface formant bilobée; entre chacun de ces lobes prennent naissance deux petits bourrelets saillants, recourbés en hameçon, qui sont connus, dans la famille des Productidæ, sous le nom d'empreintes reniformes, et qui doivent appartenir à l'appareil brachial." *Annales des Sciences, Geologie*, Vol. XIX, p. 63, pl. IV, fig. 10.

vex, had no striæ, and were strongly punctate. The interior of the brachial valve was characterized as bearing three divergent ridges in front of the muscular area.

Stropheodonta nacrea Hall, from the Corniferous and Hamilton, an unnamed species from the Corniferous, and *Strophomena lepis* Bronn. of the Middle Devonian from Eifel, Belgium, and the Asturias, were named as belonging to this division.

It has been shown that the development of the hinge structure, form of shell, and convexity of valves is very similar in the three species just described. The points of greatest difference were: first, in the striæ—*S. inaequistriata* produced new striæ by implantation; *S. perplana* by both implantation and bifurcation; and *P. iowaënsis* has normally no striæ at any stage of development; second, in the scars of the muscles—*S. inaequistriata* has a type very different from that of the other two, and, in the ventral valve, there is a change in the form of the muscles during the ephebic and gerontic stages. In the other two species no such change has been observed to occur.

Comparing the scars in the ventral valves of *S. junia*, *perplana*, *demissa* and *P. iowaënsis*, it is at once seen that they are very similar. In each, the diductors are broad, flabelliform, separated by a low septum and bounded on their posterior-lateral edges by more or less papillose ridges. In *S. demissa* and *P. iowaënsis*, they are more sharply marked in front than they are in the other two species. Between the diductors are the elongate scars of the adductors, two pairs in each case. In the dorsal valves of *S. demissa*, *S. perplana* and *P. iowaënsis*, there is more variation in the form of the scars, but it is more a variation in the limiting structures than in the shape of the scars themselves. In each, there are two pairs of scars, one pair somewhat anterior to, and between the other pair. In *S. demissa* and *P. iowaënsis* they are bounded by a ridge in front. In *S. perplana*, the anterior margin is more indefinite. The interior of the dorsal valve of *P. iowaënsis* should be compared with that of *Stropheodonta profunda* Hall from the Niagara (Pal. N. Y., Vol. VIII. I, pl. 20, fig. 30). In that species the form of the scars is almost exactly the same as in the Hamilton species, and in front of the scars there are two short, curved ridges and a prolongation of the median septum. Hall thus describes this species. "Shell large, full grown individuals having a width of 60 mm. and length of 40 mm. deeply concavo-convex. Ventral valve very convex, hinge line narrow, foramen triangular,

covered by a strong deltidial callosity. Crenulations on the interior margin are oblique, diverging from the beak, extending from the foramen less than half way to the cardinal angles. Surface marked by strong, large radiating striæ alternating with four or five smaller striæ and increasing by implantation" (Eleventh Annual Report Indiana State Geological Survey, 1881, p. 289). Here then there are examples of four of Hall and Clarke's subdivisions; Brachyprion, Leptostrophia, Pholidostrophia, and Stropheodonta (*S. demissa* type) which agree in internal structure but have great variation in external ornamentation. These facts would seem to indicate that the name Pholidostrophia should be given the same taxonomic value as the names Brachyiopriion and Leptostrophia, instead of being raised to generic rank.

The Same Species from Other Localities.

Specimens from East Bethany, N. Y., are of about the same size as the Canandaigua Lake specimens, but are somewhat wider in proportion to the length. The index is from 1.39 to 1.49 mm.

From Eighteen Mile Creek there are numerous specimens, most of which are smaller than the largest ones in the present collection. The smallest is 8×10 mm. and the largest 12×17 mm. An average specimen is 10.5×14 mm. Most of the specimens have their cardinal extremities more or less extended. One specimen that is 14 mm. wide below the hinge, measures 18.5 mm. along the hinge. Another 14 mm. in width below, is 17 mm. on the hinge. These specimens are only moderately convex and have not yet reached the stage when they are sharply deflected in front. One of the specimens shows indistinctly a few distant, radiating striæ.

Very similar to these, but with a slightly lower index, are the specimens from Thedford, Ontario. These specimens are very uniform in size. The largest is 11.5×15 mm. and the smallest 10×13.5 mm. The index is 1.30 to 1.35 mm.

NOTES ON OTHER SPECIES OF STROPHEODONTA.

S. concava Hall.

Hall, Pal. N. Y., IV, 1867, p. 96, pl. 16, figs. 12 and 15.

One well preserved dorsal valve shows the character of the muscle scars in this species. The adductor scars are large, broadly oval, and separated by a median depression in place of the usual septum. The

scars are divided into two elements, the posterior adductors, which are large and oval, and in front of and between these, the small triangular anteriors. In front of the muscle scars there is a median septum and on each side of it a rounded postulose ridge. Outside these ridges are two lower, sharper ridges one of which starts in front of each anterior muscle scar, curves slightly outward, and then in again, but does not approach much nearer the septum than it was at the starting point. These ridges probably have to do with the brachial apparatus rather than with the muscular system, as has been previously supposed.

S. junia Hall.

Hall, Pal. N. Y., IV, 1867, p. 108, pl. 18, figs. 3, 4.

Only one well preserved specimen of this species was found in the collection. It is a ventral valve, 44 mm. in length and 50 mm. wide. The hinge is crenulated for three-fifths of the distance from the beak to the cardinal extremities. The

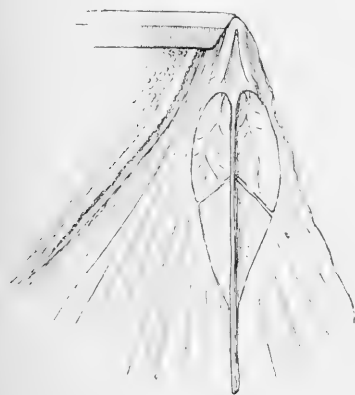


FIG. 17. *Stropheodonta junia* Hall; part of the muscle area of a ventral valve, showing the anterior and posterior elements of the adductors, and the pedicle muscle scar. $\times 3$.



FIG. 16. *Stropheodonta concava* Hall. Sketch of the cardinal process and muscle area to show the two pairs of adductor scars (the small triangles without arborescent markings represent the anteriors) the low median septum ending in a sort of saddle, and the pustulose ridges, not muscle scars, on either side of it. Natural size.

The area about the beak is broken, so nothing could be learned about the deltidium or pedicle opening. The scars of the muscles are very well marked. The diductors are large, flabelliform, faintly marked anteriorly, but with strong posterior ridges extending from the area half way down the sides. Between the diductors are the adductor impressions which are divided on the median line by a low, thin septum. These scars are long, narrow and acuminate in front. Two diagonal lines divide the scars into anterior and posterior elements and the posteriors have arborescent markings, while the anteriors, which are smaller, do not. Back of these

scars are two low processes, the remnants of the dental plates, and

on a platform made when they unite with the median septum is the scar of the pedicle muscle. The entire interior of the valve, outside the muscle scars, is covered with small pustules (Fig. 17).

S. demissa Hall.

Hall, Pal. N. Y., IV, 1867, p. 81, pl. 11, figs. 14-17, pl. 12, figs. 1-5.

This species is represented by two or three poorly preserved ventral valves. None are sufficiently complete to give measurements of length and width. The hinge structure is fairly well shown. The deltidium is broad and convex, and the pedicle opening is just at the beak. One specimen shows well the course of the pedicle. The rudimentary teeth are supported by a median septum formed by the coalescence of the two dental lamellæ. Between the teeth and running to the beak is a groove, covered over by the deltidium, thus forming a pedicle passage. The median support is very short and in front of it is the scar of the pedicle muscle.

The diductor scars are very large, flabelliform and bounded by two diverging ridges which are widely separated posteriorly. The adductors form a rather large oval scar which is divided longitudinally by a raised line. Toward the front of the scar are two faint diagonal lines which mark off the anterior adductors. They are very much smaller than the posterior pair and acuminate in front. The median septum is not strongly developed in front of these scars.

Orthothetes¹ **chemungensis** Conrad. (Plate V, Rows 1, 2.)

Hall, Pal. N. Y., IV, p. 67, pl. 10, fig. 6.

In this collection there are about four hundred specimens of *Orthothetes* representing all stages of growth from a size of .71 × .80 mm. to 16 × 22 mm. Well preserved large specimens are uncommon and the majority of the individuals are less than 10 mm. in width. On the other hand, specimens less than 2 mm. in width are common. There are in this material two species, one of which, *O. chemungensis*, is represented by two varieties, *O. chemungensis arctistriatus* Hall and *O. chemungensis pectenacea* Hall. Most of the material can be

¹In a paper on "New Molluscan Genera from the Carboniferous" (Proceedings of the U. S. National Museum, Vol. XXVII, page 721, 1904) Dr. Girty states that *Orthotetes* (*sic*) as defined by Fisher-de-Waldheim covers the type of structure for which Waagen proposed the name *Derbya*. Thus, according to Girty, *Derbya* becomes a synonym for *Orthotetes*, and he suggests *Schuchertella*, for shells of the type of *Streptorhynchus lens* White.

referred to these two varieties, while the other species, *O. bellulus* Clarke, is represented by about 60 specimens. A number of the smaller individuals retain both valves, but most are separated and there are about as many of one valve as the other.

Hall, in 1867, referred all the specimens of this genus found in the Upper Helderberg, Hamilton, and Chemung, of New York, to the single species *Streptorhynchus chemungensis* and divided it into four varieties, *S. pandora* from the Schoharie and Corniferous, *S. arctostriata* from the Hamilton, *S. perversa*, Hamilton, and *S. pectenacea* for the Chemung. He stated, however, that there exist such gradations between these that it is extremely difficult to distinguish them and that specimens exactly like *S. pandora* are found in the Chemung, while the varieties *arctostriata* and *perversa* are not confined to the Hamilton. Schuchert, in 1897, divided the group by making two species and two varieties. *Orthothes chemungensis*, including Hall's variety *pectenacea*, is restricted to the Chemung specimens. *O. chemungensis arctistriatus* to the Hamilton, *O. chemungensis perversus* to the Hamilton and Corniferous, and *O. pandora* Billings to the Upper Helderberg.

The differences between the varieties seem to have been based largely on surface ornamentation. From the descriptions given in Vol. IV, Pal. N. Y., the following principal characters are taken.

"Such forms as *S. arctostriata* have the striæ nearly equal and quite thin and prominent, but even then there are fine intermediate striæ, but the interspaces are so nearly equal that the surface presents a pretty uniform aspect, though there are many gradations. Specimens of this kind have usually very broad convex dorsal valves which are sometimes depressed in the center."

S. pectenacea. — "Surface marked by distant prominent striæ with two or three finer ones between. Well marked specimens are usually small or medium size."

Numerous specimens of these varieties are figured. The majority of them are much larger than any in the present collection. Hall states that the usual size of *S. arctostriata* is from one-quarter to three-quarter inches in length and the width one-quarter to one-third greater. The smallest specimen figured is 7×13 mm. and the average is from 16×25 mm. to 25×40 mm. It will thus be seen that the material here described consists mainly of immature and dwarfed specimens.

Developmental Changes.

The two varieties have practically the same development, as the only difference is in the time of the appearance of the new striæ. They will therefore be considered together. In the adult the two can be separated only under the most favorable circumstances. In well-preserved specimens the variety *arctistriatus* shows a surface thickly covered with sharp, subequal striæ. *O. pectenacea* has slightly wider spaces between the striæ and certain of the striæ are stronger than others. With young specimens, especially if the dorsal valves are at hand, there is no difficulty in separating them. The variety *pectenacea* has from 15 to 19 strong elevated striæ between which are lower interspaces containing one or three striæ. In the variety *arctistriatus* the striæ are so crowded together that this alternating appearance is not obtained.

Nepionic Stage. — The smallest shell in the collection is a dorsal valve .71 mm. in length and .80 mm. wide. It is almost circular in outline, slightly convex, and is smooth for half the distance to the front. There are fifteen sharp striæ, all originating at the same time.

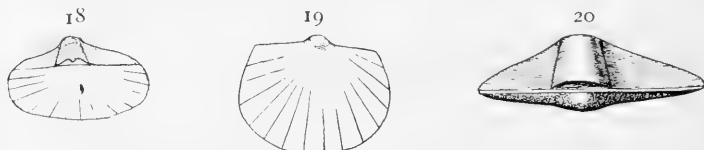


FIG. 18. *Orthothetes chemungensis* Conrad; specimen retaining both valves, and showing pedicle tube and primary plications. $\times 16$.

FIG. 19. Ventral view of the same specimen. $\times 16$.

FIG. 20. The same species. Cardinal view of another specimen showing pedicle tube and relative convexity of valves. $\times 32$.

The nepionic stage in this species is of short duration. On all the well preserved dorsal valves the smooth initial shell can be seen. It is almost exactly circular, convex, and from .35 to .43 mm. in diameter, usually about the lower limit.

The smallest ventral valve is on a specimen which retains both valves. It is .73 mm. long and 1.1 mm. wide with a width of 1 mm. at the hinge. It is subelliptical in outline, convex, with a high cardinal area. The delthyrium is almost completely closed by a strong convex deltidium, which at the apex is prolonged slightly, forming an exsert tube which is perforated for the passage of the pedicle. On this specimen there are 13 striæ on the dorsal, and 14 on the ventral valve (Figs. 18, 19).

Changes During Development.

Outline. — There is very little change in the outline except as it is affected by the irregular growth. In the nepionic stage the shells are circular but become wider than long in the earliest neanic stage and remain so through all succeeding stages. The width at the hinge is always less than the width below. The index is from 1.25 to 1.50 mm. in neanic stages and 1.50 to 1.80 mm. in adult and gerontic stages.

Convexity of Valves. — The dorsal valves of young shells are nearly flat or slightly convex, but become more convex in the adult when the greatest convexity is about the middle of the valve. The ventral valve is always more convex than the opposite one and is often rather sharply deflected in front.

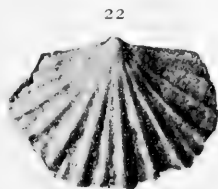


FIG. 21. *Orthothetes chemungensis arctistriatus* Hall. Diagram of a dorsal valve to show the 12 primary striae. Between two of them the secondary, tertiary and quaternary striae are filled in, to give an idea of the uniform appearance produced by the crowding of the striae. $\times \frac{3}{2}$.

FIG. 22. *O. chemungensis pectenacea* Hall. Dorsal valve, showing earlier plications. $\times 12$.

Striae. — The shell of the variety *pectenacea* has, up to a length of 1 to 1.2 mm., 13 to 15 simple, sharp striae separated by spaces which are wider than the striae. Then there appear four or six new striae in the middle of the front, implanted, one in each interspace (Fig. 22). Later more are added until there is one between each pair of the original striae. The next step is the appearance of striae, again in pairs, one implanted on each side of each of the secondary striae. At a still later stage more pairs are added, one on each side of the next previous ones to appear. So in the adult we have, considering a single unit of striae, first, two striae extending from the anterior margin to the smooth portion of the shell at the beak; second, a single striation bisecting the area between the first two but not extending to the beak; third, a pair, one on each side of the bisecting striations but not more than half as long; and fourth, four more striae, one in each of the spaces between the preceding ones. These last ones are usually

very short. Thus there are seven striæ between each pair of the original simple striæ, and theoretically, 113 striæ on the adult of an individual which, in the initial plicated stage, had 15. Very frequently, however, some of the striæ are suppressed, and this is almost always the case at the sides. In the larger specimens, more striæ are probably added in this same way (Fig 23).

In the other variety, *arctistriatus*, the method of development is the same, but the result is somewhat different. In the earliest striated stage there are from 15 to 19 sharp striæ. New striæ appear as before, but come in at earlier stages, thus covering the surface of the valve more completely, and giving a more uniform appearance to the striæ (Diagram, Fig. 23).

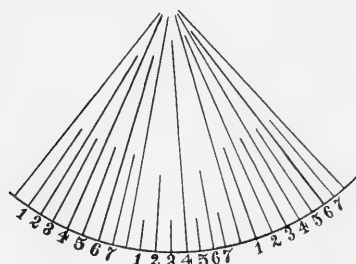


FIG. 23. Diagram showing the method of inception of plications in the two varieties of *Orthothetes chemungensis*. The seven lines in the middle represent the seven striæ as developed between two primary striæ in the variety *pectenacea*, and the other lines represent the groups of striæ in the variety *arctistriatus*. Notice that No. 4 comes in later in the middle group than in the outer ones, 2 and 6 later in the middle than 2 and 6 in the outer ones, etc.

Cardinal Area. — The height of the cardinal area varies greatly with the individual specimens. Series can be selected in which the ventral valves are subpyramidal while others have so low or curved an area that the valves are almost uniformly convex. One specimen, with a hinge width of 1 mm., has an area .36 mm. in height. One 5 mm. wide, at the hinge, has an area of 2 mm. in width. An adult, 16 mm. on the hinge line, has an area 8.3 mm. high. Another with a hinge width of 22 mm., has an area only 4 mm. high.

The area is divided by two oblique lines extending from the beak to the hinge. These lines, with the boundaries of the deltidium, form two scalene triangles, one on each side of the delthyrium. The area within these triangles is somewhat different from the rest of the cardinal area. It is striated vertically as well as horizontally, and, in some specimens where the rest of the area is punctate, this part is not so. The youngest specimens show no trace of these triangles but a specimen 3.6 mm. in width at the hinge shows the distal ends of the oblique lines 1 mm. from the extremities and the other ends close under the beak. In a specimen 5 mm. in width the triangles occupy a

slightly greater proportion of the area and their acute angles are only .75 mm. from the cardinal extremities. About the same proportion is maintained through all the succeeding stages. A specimen 20 mm. wide on the hinge line has the acute angles located 3 mm. from the cardinal extremities.

The area of the dorsal valve is linear and its growth is arrested very early in the development. The deltidium of the youngest specimen which retains it has already been described. Specimens under three or four mm. in width usually show the strong, convex deltidium prolonged below the beak and within the margin of the nepionic shell, to form a tube for the passage of the pedicle. In many cases the upper part of this tube is broken away near the surface of the shell and what remains of it appears as a rather stout conical tube with a large opening (Figs. 18, 19, 20).

In a few specimens the entire tube is retained. It then rises about 2 mm. above the beak, tapers gradually, and is perforated by a minute pore at the apex. In older specimens, 5 or 6 mm. in width, the scar of the base of this tube can be seen on the ventral beak and inside the circle formed by it there is a minute pedicle opening. In later stages the opening is hard to detect and seems to be closed entirely in adult specimens.

In no stage is there much open space at the lower end of the delthyrium. As the cardinal process increases in size it projects more and more beyond the dorsal beak and the deltidium becomes correspondingly convex, so that the two fill the delthyrium completely. The deltidium is, in some cases, grooved in such a way as to conform to the shape of the posterior face of the cardinal process.

The cardinal process is large, bilobed as seen from the front, and quadrifid on the posterior face. It is supported by the lamellæ of the dental sockets which rise rather abruptly as thin curved plates and run transversely under the umbo, curving backward to join the cardinal process. There is little change in the form of the process during life, except that it curves more backward and upward in the later stages until it comes up close to the beak.

In the ventral valve the delthyrium is limited by two strong dental lamellæ which extend slightly beyond the hinge line. In young and adult stages they are unsupported, but in gerontic shells they are braced by two outward curving plates which connect them with the inside of the shell at the umbo.

The Same Species in Other Localities.

The specimens from Pompey Hill, N. Y., are all small. The largest is 17×25 mm. and the smallest 8×12 mm. A specimen 13×19.5 mm., which is of average size for this locality, has 100 striæ. The dorsal valves of these specimens are nearly flat, and the ventral valves low, but distorted about the umbo.

The specimens from Pratt's Falls, N. Y., are of about the same size and proportions. The smallest is 5×7 mm. Another is 8.5×12.5 mm. and has 70 striæ. A third is 13×20 mm. with 110 striæ and the largest specimen is 17.5×23 mm. These specimens have very low cardinal areas and are hardly at all distorted.

The specimens from both localities belong to the variety *arctistriatus*.

Ortothetes bellulus Clarke. (Plate V, Row 3.)

Clarke, 13 An. Report N. Y. State Geol., 1895, pp. 176, 187, pl. 4, figs. 2-4.

This species is represented by a less complete series than *O. che-mungensis*. The range in size is from 1.4×2.3 mm. to 10×14.5 mm. Between these limits there are specimens which show all stages up to the adult condition, but none show senile characters and probably the normal size of the adult is not attained, judging from the case of the other species of this genus.

The individuals figured by Clarke differ in minor respects from the present specimens and a portion of his description of the *Marcellus* species is quoted. "This species is of persistently small size and quite regular in form, none of the specimens showing umbonal distortion. The valves are transversely elongate, the hinge line forming the greatest diameter. The surface is covered with eighteen or twenty sharp, narrow, distant plications, . . . and in the middle of each of the broad interspaces is a smaller and usually obscure rib: rarely two of these ribs are present. The length of an average specimen is 10 mm.: its diameter along the hinge is 15 mm. This is from the limestone of the *Marcellus* division at 854 feet in the (Livonia Salt) shaft."

Nepionic Stage. — The shell is very small in the nepionic stage. It is almost circular, biconvex and smooth. The diameter is from .10 to .12 mm. as preserved on the beaks of dorsal valves from 1.4 to 3 mm. in length.

Changes During Development.

In the earliest stage in which striæ appear there are from eleven to fifteen. New ones are added by intercalation at an early stage so that the smallest specimen, 1.4 mm. long, has 18 striæ. In the adult there are from 24 to 30. In all other characters than the striæ the development is the same as in *O. chemungensis*. The index is very constant, for, neglecting the nepionic stage where it is practically 1, it varies from 1.25 to 1.50.

Specific Characters of the Shell.

As Developed in the Upper Hamilton. — Biconvex or plano-convex, transversely elongate, with a hinge width less than the greatest width below. Area of ventral valve high, frequently distorted. Dorsal area linear. Delthyrium completely closed by a very convex deltidium, which, in young stages, is prolonged into an exert pedicle tube. In the adult the pedicle passage is closed.

Surface marked by 24 to 30 strong simple plications, which increase by implantation. Between them are spaces which are wider than the plications. Very numerous concentric lines cover the entire surface. Shell substance highly punctate. The punctæ lie in double rows between the plications.

A species, which, if not identical with this, is at least very closely related, is *Orthothetes flabellus* White, from the Upper Helderberg of Columbus, Ohio. This species is larger than the specimens in the present collection and has the greatest width at the hinge. The striæ, which are simple, number 22 or 24 and are separated by wide concave interspaces. The specimen figured is 22 mm. long and 26 mm. in width.¹

Orthothetes : Summary. — The development of two other species of *Orthothetes* has been worked out. That of *O. subplanus* of the Niagara by Beecher and Clarke² and of *O. minutus* of the Salem Limestone by Cumings.³

O. bellulus has in its adult stage many characters which agree with the neanic stages of *O. minutus*. That species has in its earliest plicated stage eighteen plications and more are added in the same way

¹ See *Annals N. Y. Acad. Sci.*, 1891, p. 521, pl. 6, figs. 7-9.

² *Memoirs N. Y. State Museum*, Vol. I, No. 1, 1887.

³ *Orthothetes minutus*, *Am. Geol.*, Vol. XXVII, March, 1901, p. 147, pl. XVI, figs. 1-11.

as in *O. bellulus*. In the adult, dwarfed, 4×5.5 mm. there are 40 plications.

Comparing the development of *O. chemungensis* with that of *O. subplanus* of the Niagara we find many differences.

1. In convexity of valves. The nepionic shells of *O. chemungensis* have the valves subequally convex, which is the adult state in *O. subplanus*, while its nepionic shell is concavo-convex.

2. In *O. subplanus* the cardinal area is low compared with the length of the hinge line and the adults are symmetrical. In *O. chemungensis* only in the early neanic stages are the shells perfectly symmetrical in most cases, though some specimens with low cardinal areas retain their symmetry into late neanic stages.

3. In surface characters. The duration of the nepionic stage is about the same in both species. In the youngest specimen of *O. subplanus*, figured by Beecher and Clarke, 2.25 mm. long, there are seventeen striæ, six of which are secondary. A specimen of *O. chemungensis* of similar length has from twenty-eight to thirty-five striæ.

4. Hinge structure. The young of both species have a strong convex deltidium which is prolonged into an exert tube for the passage of the pedicle. In *O. subplanus*, the deltidium ceases to grow at an early stage, while in *O. chemungensis* it continues to increase in size throughout the life of the individual.

The first three of these differences point to an earlier acquisition of the characters through acceleration. The last would tend to show that *O. chemungensis* was in a progressive rather than a retrogressive line of development.

Chonetes coronatus Conrad. (Plate VI, Rows 3 and 4.)

Hall, Pal. N. Y., IV, 1867, pl. 21, figs. 9-12.

This is the least common of the three described species of *Chonetes* so abundant in the silicified material. About five hundred good specimens were obtained, nearly all of them detached valves. Ventral valves are the more common and also the better preserved. All gradations from specimens 1.2×1.3 mm. to those 15.4 by 23 mm. are found, while from a study of the umbos of the small specimens still younger stages can be made out.

The smallest specimen figured by Hall is 10.8 mm. long and 14 mm. wide. The largest is 22 by 41.5 mm.

Nepionic Shell. — In the nepionic stage the shell is almost circular in form, the hinge line slightly curved and almost as long as the greatest width below. Both valves are convex, the ventral more so than the dorsal. In the ventral valve there is a narrow, well defined sinus, and a corresponding fold occurs in the dorsal shell. The length of the nepionic shell varies from .30 to .45 mm. and the width is slightly greater (Fig. 24).



FIG. 24. *Chonetes coronatus* (Conrad). Dorsal valve of a young specimen, showing protogulum, nepionic shell with dorsal fold, and the shell of the pauciplicate neonic stage. The radial lines represented crests of the plications. $\times 9$.

Changes During Development.

Outline. — The outline of shells less than 2 mm. in length is quite variable. In some, the length nearly equals the width, while others are from one-third to one-half wider than long. In general, the shell becomes wider, in proportion to its length, as it grows older. The index varies from 1.09 to 1.49. Shells less than 6 mm. wide usually have an index of less than 1.30. In the larger shells the index averages about 1.40. From the beginning of the neanic stages the hinge width equals or exceeds the width below. In adult and senile specimens the greatest width is below the hinge.

Convexity of Valves. — The ventral valve is moderately and evenly convex throughout all the stages. The dorsal valve is convex during the nepionic stage, but becomes concave immediately in front of the smooth part of the shell and continues slightly concave to the front.

Striæ. — The smallest plicated shell seen has eight strong striæ on the dorsal valve and nine on the ventral. The shell at this stage, is .65 mm. long and 1.00 mm. wide. The first striæ on the dorsal valve appear to be formed by the bifurcation of the fold of the nepionic shell, and on the ventral valve the first four are formed by the bifurcation of the two ridges which bound the sinus in that valve. Then four more striæ are added on each valve, two on each lateral margin and two striæ are implanted on the dorsal valve, just outside the two striæ formed by the bifurcation of the dorsal fold. A single striation is implanted in the sinus of the ventral valve as the ventral shell conforms to the depression in the dorsal shell, caused by the bifurcation of the fold. From this point, striæ are added on the lateral margins until there are twelve or fourteen on the dorsal valve and thirteen or fifteen on the other. At this stage, the shell is usually about 3 to

3.5 mm. long and 4 to 4.5 mm. wide. Then the striæ begin to increase by both bifurcation and implantation. During the latter neanic stages there are from 30 to 60 striæ and, in the adult, 80 to 100.

The implantation of new striæ seems to be due to a mechanical cause, namely, the thinness of the shell. When the striæ on one valve bifurcate, a depression is, of course, formed between them. As the other shell conforms to this irregularity on the frontal margin, a single striation is produced. The increase of striæ by implantation does not seem to be confined to either valve, but occurs on both. One specimen, in which bifurcation of the striæ has just begun, shows this process well. On the dorsal valve there are twelve primary striæ, one of which, near the middle of the valve, has bifurcated. On the ventral valve there are thirteen striæ, two of which have bifurcated. On the dorsal valve, there are two implanted striæ which correspond in position to the depression between the bifurcated striæ on the opposite valve, while on the ventral valve there is one implanted striation corresponding to the bifurcated one on the dorsal valve. There is, however, nothing regular in the number of implanted and bifurcated striæ on each valve, for, as Hall has remarked, sometimes one valve will have almost all of its secondary striæ added by implantation and again by bifurcation, or by both ways in all proportions.

Hinge Development. — In the early stages the area of neither valve is well developed and the shell is so fragile that no traces of the deltidium or chilidium are preserved in any of the small specimens. In the latter neanic and adult specimens there is a narrow cardinal area on each valve. That of the dorsal valve is about one half to three fourths as wide as the ventral area. Covering the apical portions of the delthyrium there is a convex deltidium, while the larger part is filled by the cardinal process. No pedicle opening was observed.

On the dorsal valve there is a narrow chilidium covering the posterior end of the cardinal process and the ends of the dental sockets. The cardinal process is strong, roughly triangular, deeply bifurcated, and each lobe is again divided by a shallow groove.

In the ventral valve there are two strong striated teeth rising in front of, and below, the cardinal area. They curve upward and inward. In the dorsal valve there are deep grooves on each side of the cardinal process which are bounded on the inside by slight projections from the process and on the outside by strong diverging lamellæ. The articulation appears to be the same as in *Tropidoleptus*.

Muscle Scars. — The scars of the muscles are so faintly impressed in young specimens, that they cannot be made out. In the ventral valve of the adult are two large flabelliform diductors and between them the narrow elongate scars of the adductors, one on each side of the median septum. The scars of the muscles attached to the dorsal valve are described under *C. mucronatus*. Outside the scars, in this valve, the whole surface is covered by numerous radiating rows of small, sharp, forward-pointing pustules.

Spines. — The number and place of appearance of the spines varies somewhat in the different individuals, and the bases of the earlier spines become so obscured that it is often difficult to recognize them.

On most individuals with a hinge width of 3 mm. there are 6 spines. On individuals in most of the neanic stages there are 6 to 14 spines; on adults, 14 to 20. In this reckoning, spines and spine bases from which spines have been broken or worn, are counted as spines.

The spines do not appear in exactly symmetrical positions on each side of the beak and there are not always the same number on each side, though usually there are. The departure from the symmetrical is not great, varying from a few hundredths of a millimeter, near the beak, to 1 or 2 mm. in case of spines near the cardinal angles.

The first spines appear about .25 to .35 mm. from the beak, the second .54 to .75 mm. and so on. The averages of a number of measurements are: For 1st pair, .30 mm.; 2d, .62 mm.; 3d, 1.10 mm.; 4th, 1.62 mm.; 5th, 2.32 mm.; 6th 3.11 mm.; 7th, 4.81 mm.; 8th, 6.16 mm.; 9th, 8.08 mm.; 10th, 10.5 mm. It would seem that, in many cases, certain of the spines were suppressed. For instance, in one specimen 8 mm. wide, there are only six spines. The first pair is .66 mm. from the beak, the second 1.5 mm., and the third 3.3 mm. Comparing these measurements with the averages given above we find that these spines are the second, fourth and sixth pairs. Very likely the first pair was formerly present, but are so entirely broken away as to leave no trace. In all specimens examined the second pair could be seen, and, in nearly all, the third pair.

The spines make a small angle with the cardinal line, usually less than 45° . The variation is from 18° to 43° , and the average is about 35° .

The Same Species from Other Localities.

Specimens from Sheldrake, Cayuga Lake, N. Y., are larger than the specimens just considered. An average specimen is 20×29 mm. and has 150 striæ. There is a broad shallow sinus in the ventral valve.

The individuals in the material from East Bethany, N. Y., also average larger than the Canandaigua Lake specimens. The largest specimen is 21.5×30 mm. and has 125 striæ. The smallest is 10×15 mm. with 50 striæ and five pairs of spines. A specimen of about the same size from the silicified material has 80 striæ. These specimens do not show the sinus in the ventral valve.

The Eighteen Mile Creek, N. Y., specimens are more clearly the size of the individuals from Canandaigua Lake. The smallest is 11×15 mm. with 54 striæ. A larger one is 15.5×23 mm., with eight pair of spines and 82 striæ. The largest specimen is 18×25 mm. Some of these shells show a sinus in the ventral valve and a fold in the dorsal valve. Others do not have either.

Chonetes scitulus Hall. (Plate IV.)

Hall, Pal. N. Y., IV, 1867, p. 130, pl. 21, fig. 4.

Of this species there are about 3,500 specimens, among which are individuals showing all stages of development. The smallest shell is .93 mm. long and 1.01 mm. wide. The largest 6 mm. long and 9 mm. wide.

The smallest specimen figured by Hall, is 7×9 mm. and the largest (from the Hamilton) is 8.4×12 mm. The Chemung specimens are, according to that author, usually larger. A figure of the protegulum of this species has been published by Beecher (*Am. Jour. Sci.*, Vol. XLI, 1891, p. 357, pl. 17, fig. 14). It is oval in outline, slightly longer than wide, and has an arcuate hinge.

Nepionic Shell. — The nepionic shell is subcircular in outline with a hinge width a little less than the greatest width below. In the ventral valve there is a narrow, shallow sinus, bounded by two ridges. In the dorsal valve there is a median fold which extends to the beak and, on either side, a lesser fold which does not reach the beak nor join the median fold. The lateral folds are less distinct than the median one and die out toward the front.

The length of the shell at this stage varies from .42 to .56 mm. On a specimen from Thedford, Ont., the ventral shell at this stage is .42 mm. long and .46 mm. wide.

Changes During Development.

Outline. — Until the shell reaches a length of about 1.5 mm. the length and width are nearly equal, and the index is from 1.08 to 1.20.

There is no great variation from this outline during the life history, although some individuals have unusual proportions. The average index, for adult specimens, is about 1.30.

Convexity of Valves. — In the nepionic stage the ventral valve is slightly convex. The dorsal valve is convex for about half its length and then becomes concave. The ventral valve is only moderately convex in the earlier neanic stages, but in later neanic and ephebic stages it becomes strongly so. The dorsal valve follows the contour of the opposite one quite closely.

Striæ. — The smallest shell, a ventral valve, shows six striæ. Each of the ridges which bounds the median sinus divides, making four striæ, and one is added on each margin. In the next stage a striation is implanted in the sinus and two more are added on the lateral margins, making nine in all. The smallest dorsal valve in the collection, 1 mm. long and 1.12 mm. wide, shows a condition corresponding to this stage. It has eight striæ, the middle pair of which originated by

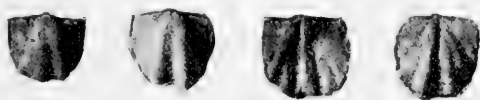


FIG. 25. *Chonetes scitulus* Hall; ventral and dorsal valves, showing fold and sinus and plications of very young specimens. $\times 12$.

the bifurcation of the median fold of the nepionic shell. In the next stage, four more striæ are added, on each valve, outside the older ones, making 12 on the dorsal and 13 on the ventral valve. From that point new striæ are added in front by implantation and bifurcation. The whole process is the same as in *C. coronatus*. The adult shell has from 30 to 40 striæ, counted on the anterior margin.

Hinge Development. — The area is narrow on both valves. That of the dorsal valve is a little more than half as wide as the ventral area. In one adult specimen, the ventral area was .44 mm. wide at the apex and the dorsal area, .25 mm.

The delthyrium is wide, the upper third covered by a convex deltidium and the remainder filled by the cardinal process. The deltidium continues to grow throughout life but is so curved back in its lower part that the cardinal process fills the larger part of the opening. No pedicle opening has been observed on the specimens in this collection. On the dorsal valve there is a very narrow chilidium at the apex, covering the base of the cardinal process. In nearly all speci-

mens it is much eroded, as is also the outer face of the process. The cardinal process is about as wide as long and bifid. The posterior face is divided only once instead of into four parts as in *C. coronatus*. At the sides of the process are deep sockets, and in the ventral valve strong striated teeth. The same arrangement for articulation can be seen in a specimen one mm. in length, and seems to undergo no modification during development.

Muscle Scars. — In the ventral valve, the muscle area consists of two very large flabelliform diductor impressions, between the posterior ends of which are two oval scars of the adductors, one on each side of a thin septum. The interior of the brachial valve is described under *C. mucronatus*.

Spines. — Individuals over 1 mm. in length have two pairs of spines on the ventral valve. At 3 mm. in width there are four pairs. As in *C. coronatus* the spines near the beak are represented on the adult shell by the bases only. The average distances of the spines, from the beak, are as follows: 1st pair, .28 mm.; 2d, .55 mm.; 3d, .96 mm.; 4th, 1.41 mm.; 5th, 1.73; 6th, 2.18; 7th, 2.91; 8th, 3.69.

The spines of this species are more erect than in any of the others here described. They project at angles of from 45° to 70° with the hinge.

The Same Species from Other Localities.

Specimens from Pratts Falls, N. Y., are, on the average, somewhat smaller than those just discussed. The smallest specimen is 2.2 × 3 mm. and has 19 striæ. The largest is 5.5 × 8 mm. with 30 striæ. The spines extend out at angles of from 60° to 70° with the hinge. On one specimen the outer spines are 2.5 mm. long.

The material from Eighteen Mile Creek contains many individuals, some of which are larger than those from Canandaigua Lake. The smallest specimen is 4 × 5 mm. and the largest 9 × 12 mm. The number of striæ varies from 27 to 60. An average specimen is 7 × 11 mm. and has 53 striæ.

The specimens from Thedford, Ont., are of about the same size and shape as the silicified specimens, but have more striæ. They range in size from 5 × 7 mm. to 7 × 9 mm. and an average individual has about 44 striæ. Many of the adults show all stages of growth, beginning with the nepionic.

Chonetes mucronatus Hall. (Plate V, Rows 4 and 5.)

Hall, Pal. N. Y., IV, 1867, pl. 20, fig. 1, pl. 21, fig. 1.

Of this species there are about 1500 specimens in the collection, nearly all of them detached valves. All stages of growth are shown. The smallest specimen is 1.09 mm. long and 1.13 mm. wide; the largest, 11 mm. long and 13 mm. wide. Hall does not illustrate any specimens of this species from the Hamilton. Those that he figures from the Corniferous and Marcellus are smaller and less convex than the major part of the adults in this collection. The smallest specimen figured by him is 5.6×6.8 mm. and the largest 6.4×8.2 mm.

Nepionic Shell. — In the nepionic stage the shell is subcircular in outline, the ventral valve convex, and the dorsal valve convex at the umbo and concave in front. There is a faint median sinus in the ventral valve, but the ridges bounding it are not as strong as in the other species. On the dorsal valve there is a sharp median fold which extends only about half way to the front and then dies out. Faint traces of a pair of lateral folds can be seen. The size of the shell at this stage varies in the different individuals. For one specimen the dimensions are: length .59 mm., width .62 mm., width of the hinge .56 mm., length of the dorsal fold .37 mm. In other specimens the nepionic shell reaches a length of .75 to .90 mm.

Changes During Development.

Outline. — At the beginning of the neanic stages the hinge length becomes as great, and then greater than the width below and remains greater until senile characters begin to appear. In all stages the width of the shell is somewhat greater than the length. The greatest excess of width over length occurs in the later neanic and early ephelic stages when the index is about 1.30 to 1.40 mm. In the earlier neanic stages the index is 1.10 to 1.20 mm. and with the accession of the gerontic characters it falls to 1.25 mm. or even less.

Convexity of Valves. — In the neanic stages the ventral valve is very moderately convex and the dorsal valve slightly concave, often nearly flat. In the adult and gerontic stages the ventral valve becomes strongly convex and finally gibbous. The dorsal valve is rather strongly concave a little anterior to the middle.

Striæ. — Owing to the low, rounded, often indistinct character of the striæ, it was not possible to make out clearly all the steps by which

the striæ are introduced in this species. A ventral valve 1.41 by 1.59 mm. has seven striæ, one of which originates on the median line somewhat later than the others. A larger specimen, 1.72×2.06 mm., has nine striæ. A dorsal valve of about the same size, 1.72×2 mm., has eight striæ, two of which, in the middle of the valve, are longer than the others, but do not seem to join the median fold of the nepionic shell. After this stage more striæ are added at the lateral margins and, occasionally, by bifurcation and implantation, but the number is, at all stages, very irregular. One specimen, 3×4.23 mm., has 14 striæ, while one, 4.30×5.61 mm., has only 9. In the adult stage there are from 25 to 40.

Hinge Characters. — The area on both valves is narrow, that of the dorsal valve being about one half as wide as the other. In all stages the delthyrium is closed by a convex deltidium which covers about two thirds of the opening. The chilidium on the dorsal valve is nearly as wide as the greatest width of the cardinal area.

Muscle Scars. — In the ventral valve are the two large flabelliform scars of the diductors and between them the smaller adductor scars. In the dorsal valve, just anterior to the cardinal process, are two small oval scars, and, between them, a pair of slightly larger scars separated by a low rounded septum. In front of these adductor scars are large brachial areas which extend nearly to the anterior margin of the shell. Each brachial area consists of two parts. On the outside there is a rather strongly marked reniform impression which begins just outside the muscular area and extends around to the front of the shell. Within the crescent formed by this impression is a raised portion, which is smooth and limited on its inner side by a ridge.

These ridges originate at the sides of the median septum at about the middle of the muscular area and extend three fourths of the distance to the front of the shell, diverging at only a small angle from the median septum. At their anterior ends they are usually high and sharp, terminating rather abruptly.

Chonetes scitulus and *C. coronatus* have the same markings on the interior of their dorsal valves, but they are less deeply impressed. In *C. coronatus* the middle (anterior) pair of muscle scars are long and narrow, while the outer pair are larger and roughly rectangular. The brachial areas can hardly be divided into two elements in the majority of the specimens of this species, and in the young individuals no impressions at all can be made out. The diverging ridges on each

side the median septum are low and do not end in prominent projections.

In *C. scitulus* the ridges are very prominent and usually pustulose. The muscle scars are not strongly marked, but the reniform part of the brachial impression is deeply excavated and is limited by concentric rows of strong pustules. In front of these rows of pustules all around the margin of the inner surface of the shell there is a border which is almost smooth.

Spines.—The spines on this species are better preserved than on any of the others in this material. They are larger and coarser, and are also protected by lying against the shell and each other. The smallest shells in the collection show the bases of two pairs of spines, and the adults show remains of from four to seven pairs. The average distances at which they emerge are as follows: 1st pair, .53 mm.; 2d, 1.16 mm.; 3d, 2.01 mm.; 4th, 2.54 mm.; 5th, 3.41 mm.; 6th, 4.40 mm.; 7th, 5.53 mm.

Gerontic Stage.—With old age the shell becomes greatly thickened, the muscle scars more deeply impressed, there are numerous strong varices of growth near the margin, and the striæ become faint or entirely obliterated in the front. The shell becomes gibbous, the width below becomes greater than that at the hinge, and there is a constriction just in front of the cardinal area which gives a sort of auriculate appearance to the cardinal extremities. When this occurs the plane of the ventral area is revolved inward from its normal position.

Comparison with Specimens from Other Localities.

The specimens from Pompey Hill, N. Y., have about the same size and index as the above, but usually have fewer plications. A specimen 7.5×10.5 mm. has 18 plications, and one 7×9.5 mm. has 22, while individuals of that size from Canandaigua Lake have from 25 to 30. The largest specimen is 10×14 mm. and the smallest 4×5 mm. The index in adults is from 1.22 to 1.40 mm.

Three specimens from Pratt's Falls, N. Y., are of fair size, 8×11 mm. to 9×12 mm., and have from 22 to 30 striæ. The spines extend nearly parallel to the hinge.

In the collection there are numerous specimens from Eighteen Mile Creek, most of which are smaller than the average specimens from Canandaigua Lake. The largest one is 8×13 mm. with 35 striæ, and the smallest is 5.5×8 mm. An average specimen is 7.5×10 mm.,

and has from 25 to 28 striæ and six pairs of spines. Except in a few specimens showing senile characters, the hinge width is the greatest width of the shell.

Chonetes robustus Raymond. (Plate 7, Rows 1 and 2.)

Am. Jour. Sci., Vol. XVII, p. 289, pl. XVII, Rows 1 and 2, April, 1904.

This species is represented by specimens in the neanic and ephebic stages only, so a complete developmental series could not be obtained. The smallest specimen is 2.6 mm. long, and 3.2 mm. and the largest 11.06×14.33 mm.



FIG. 26. *Chonetes robustus* Raymond. Ventral valve of a typical specimen from the writer's collection. $\times 2$.

Nepionic Stage. — The beaks of the valves are not well enough preserved to show the outline of the nepionic shell, so its exact size and contour is not known from these specimens. The dorsal valve has a median fold and two lesser lateral folds. This valve was convex at the beak and concave in front. The ventral valve is convex with a narrow median sinus. In one specimen the dorsal fold extends for .60 mm., and in another .66 mm., so the nepionic shell was probably of about that length.

Changes During Development.

Outline. — The outline of no shell less than 1.93×2.92 mm. can be made out, so the list of changes is very incomplete. Until the shell reaches 6 mm. in length the index is very constant at about 1.40. Older shells have the length and breadth a little more nearly equal and the index falls to 1.20 in the largest shell in the collection. In most of the specimens the width of the shell at the hinge, is greater than the width below, but in two of the largest individuals it is a little less.

Convexity of Valves. — The ventral valves of the younger shells are only slightly convex, but in mature specimens they become very strongly so. The dorsal valve is flat or slightly concave in the younger stages, but is strongly concave toward the front in adults.

Striæ. — One of the nepionic characters, the absence of striæ, continues into the early neanic stages. In some individuals this smooth state is retained longer than in others. The largest smooth shell is a dorsal valve 3.16 mm. long and 3.4 mm. wide. On another this

smooth character extends for a length of only 1 mm. and there are many specimens which are between these limits.

In the earliest plicated stages seen, there are 12 striæ on the dorsal valve and 13 on the ventral. One specimen showing this stage is 5.15 mm. long and 6.38 mm. wide. The striæ are all simple and the ones in the middle are longer than those on the sides. Other smaller specimens show this same number, or, in some cases, more striæ. A specimen 1.93×2.92 mm. shows 15 striæ. A dorsal valve 5.13×7.66 mm. shows 16 simple striæ, and a ventral valve, 6.46×7.93 mm. has 19. On specimens larger than this new striæ are added by bifurcation or by the implantation of new striæ between older ones. The highest number on any of the shells was 36 and the usual number for adults is 20 to 30.

Character of Hinge.—The area of the ventral valve is narrow in the adult, but about twice as wide as that of the dorsal shell. The delthyrium is rather narrow and is completely covered by the slightly convex deltidium. A pedicle opening can be seen in one or two of the adult specimens. On the dorsal valve there is a chilidium posterior to the dental sockets and cardinal process.

Muscle Scars.—In the ventral valve are the large, flabelliform impressions of the diductor muscles, and the narrow, elongate adductor scars. In the dorsal valve the middle pair of adductor scars are elongate oval, and situated on a sort of platform just in front of the cardinal process. On either side and at a lower level are the rounded outer scars. The brachial impressions are large and rounded and their limit is marked by a single row of pustules. The medium septum and the two lateral ridges are faintly marked.

Spines.—Owing to the small number of ventral valves the position of all the spines could not be determined as satisfactorily as with the other species. Ten specimens were measured and the averages are as follows: 1st pair, .47 mm. from beak; 2d, .96; 3rd, 1.29; 4th, 2.03; 5th, 3.30; 6th, 4.24; 7th, 5.61; 8th, 6.16; 9th, 8.33. Thus if all the spines were developed on one individual, there would be nine pairs, but the specimen in this collection which bore the greatest number had only six pairs and the majority of them had only 4 or 5 pairs. The spines stand out at about the same angle with the hinge as do those of *C. coronatus*. The limits were 21° and 40° , but the average was above 30° .

Same Species in Other Localities.

There are three specimens in the museum collection from East Bethany, N. Y., which are labelled *C. mucronatus* but whose sharp, distant striæ and smooth umbos show that they belong to the species here described. One is 6×8 mm. and has 20 striæ; a second is 6×9 mm. with 24 striæ and the largest is 8×10 mm. and bears 22 striæ and 4 pairs of spines. They are slightly less gibbous than the Canandaigua Lake specimens but are in other respects the same.

On the beak and umbo of the ventral valve of one specimen are growth lines marking the early stages. The smallest of these is .35 mm. long and .41 mm. wide and the next is .65 mm. long and .91 mm. wide. There is a narrow sinus which does not extend quite to the second growth line but that line probably marks the limit of the nepionic shell. It is slightly convex, and the hinge width is about equal to the width below.

The plications begin beyond a line 2.2 mm. from the beak. At this stage the shell is 3.6 mm. wide, and the cardinal extremities are a little extended.

Chonetes: Summary. — All the species of *Chonetes* here described have, as would be expected, the same general type of changes in development. The different species are here compared at the various stages.

Protegulum. — The shell in this stage is exceedingly small, but in none of the specimens in the present material are the beaks well enough preserved to show it. From Beecher's work we know that in *C. scitulus* the protegulum is nearly circular in outline (.117 mm. long and .111 mm. wide, according to the figure) with a strongly arcuate hinge.

Nepionic Stage. — The species agree in having the shell at this stage convex in the ventral valve and convex at the umbo and concave or flat in front in the dorsal valve. This is an advance on the condition in *Strophcodonta* where the dorsal shell was convex during the whole of the nepionic stage.

The ventral valve always has a narrow sinus and the dorsal valve a corresponding median fold and usually two less definitely marked lateral folds.

The outline is subcircular, though the width is usually a little greater than the length. The hinge is somewhat arcuate. The length of the

neponic shell varies considerably in the different species, but is always less than 1 mm. It is least in *C. coronatus* and greatest in *C. mucronatus*.

Pauciplicate Neanic Stage. — In this stage new striæ are introduced by implantation and not by the bifurcation of the older striæ. The striæ are strong, simple, and separated by spaces as wide as the striæ. The number of the striæ is not great. In *C. coronatus* and *C. scitulus* the largest number is usually 13 on the ventral valve and 12 on the dorsal. In the other species there are more, but usually less than 20.

The shell is about one fifth wider than long, and gently concavo-convex. The first spines (usually two or three pairs) appear during this stage. The size of the shell at the end of this stage, that is, when the striæ begin to bifurcate, is least in *C. scitulus*, where it is about 2 mm. in length, and greatest in *C. robustus*, where it reaches a length of 6.5 mm.

Later Neanic and Ephebic Stages. — It would be difficult to make any sharp line which would mark the end of the adolescent period and the assumption of all the adult characters. The size, convexity of valves and number of striæ continue to increase during these stages; the width becomes greater in proportion to the length and a number of pairs of spines are added on the cardinal margin.

Gerontic Stage. — Senile characters are not well shown except in *C. mucronatus*. In all, this stage seems to be accompanied by a thickening of the shell, a deepening of the muscle scars and a growth of the anterior part of the shell, which reproduces the early neanic condition of length almost equal to breadth; and an increase in the convexity of the ventral valve.

The simplest type of *Chonetes* would then seem to be one with a moderately convex ventral valve, the width a little greater than the length, the pedicle tube open at maturity, the surface covered with simple striæ and with few pairs of spines. Of the species here discussed *C. robustus* is the most primitive in its character, as is shown by the continuation of the smooth state into the early neanic stage, the large size of the shell and the comparatively large number of striæ acquired before the end of the "pauciplicate" neanic stage, and the retention of the open pedicle tube in the adult.

Of the species in the older formations, *C. cornuta* Hall of the Clinton and *C. undulata* Hall of the Niagara show some of the primitive

characters. Hall, in describing the former species in Vol. II, Pal. N. Y., p. 64, says: "Surfaces covered with fine equal striæ which are equal to the spaces between them: striæ round, straight, bifurcating. Three spines on each side of the beak. The species is more flat than the small one in the Corniferous and Hamilton group which it resembles." In the 11th Indiana Report, p. 293, Hall says of the same species: ". . . in *C. cornuta* the interstices are wider than the striæ, and the latter increase only by interstitial additions below the middle of the shell." The size of the shell, according to Hall's figures, is about 4.2×5.5 mm.

Chonetes undulata, in the specimens figured,¹ has 21 simple striæ on the ventral valve and is 3 mm. long by 4.75 mm. wide. In his description Hall says "Surface marked by obscure radiating plications which are broad and rounded below and obsolescent toward the beak: cardinal margin of the ventral valve ornamented by two diverging spines on each side of the beak. . . . The bases of two spines on each side of the beak are usually preserved and no specimen examined has more than that number."

***Stropholasia truncata* Hall.** (Plate VII., Rows 3 and 4.)

Hall, Pal. N. Y., Vol. IV, 1867, p. 160, pl. 23, figs. 12-24.

Of this species there are about 50 good specimens in the collection.



FIG. 27.
Stropholasia
truncata
Hall; dorsal
beak, show-
ing protegu-
lum and ne-
pionic shell.
 $\times 16$.

There are about as many of one valve as of the other. The largest specimen is 8.33 mm. long and 10 mm. wide: The smallest 2.06×2.69 mm. All of the specimens from this material are small for the species. The smallest specimen figured by Hall is 10 mm. long and 12 mm. wide while the largest is 17 mm. long and 18 mm. wide.

Nepionic Shell.—Owing to the deformation of the ventral beak and umbo resulting from the method of attachment, very little could be made out concerning that valve in the youngest stages except that it is regularly and moderately convex. The smallest ventral valve is 2.93 mm. long, and 3.33 mm. wide. The beaks of some of the dorsal valves are extremely well preserved and all stages from the protegulum to the adult can readily be observed. The protegulum is transversely oval, with a gently curved hinge. In the best preserved specimen it is .131 mm. long and .156 mm. wide (Fig. 27).

¹ Eleventh Ann. Report, Indiana State Geol., p. 294, pl. 22, fig. 15.

The dorsal valve of the nepionic shell is subcircular in outline, with the hinge line equal to, or greater than, the width below. It is convex on the umbo and sometimes for its whole length, but is generally concave in front. The surface is smooth, without spines.

Changes During Development.

Outline.—The general outline remains much the same throughout life. In the later stages the width is slightly greater, in proportion to the length, than in the younger specimens. The index varies from 1.10 to 1.25. There are a few individuals with higher indices, one of 1.27 and one of 1.35. The length of the hinge is always less than the greatest width in all stages after the nepionic.

Convexity of Valves.—In the neanic stages the ventral valve is moderately convex and the dorsal valve convex at the umbo and concave in front. In the adult, the ventral valve is very strongly convex, while the dorsal valve is correspondingly concave toward the front.

Surface Markings.—There are no striæ at any stage. After the nepionic stage, spines are developed on both valves, but more numerous on the ventral than on the other valve. On the dorsal valve they are generally broken off close to the base, but one specimen retains two of the spines, which are long, slender, and lie against the surface of the valve. On the ventral valve they are better preserved, in some cases most perfectly. They are most abundant along the cardinal margin and stand erect, curving in toward each other from opposite sides of the beak, suggesting that they might have been of use in anchoring the shell. Over the rest of the surface they are directed forward.

There is one dorsal valve, 3.66 mm. by 5 mm., which is devoid of any trace of spines. This may represent another species.

On all the dorsal valves there are, in addition to the spine bases, four or five pairs of wrinkles near the cardinal margin. Between them are pits which may represent the points of attachment of spines as wherever the spines of the dorsal valve have been detached shallow pits are left in the shell.

Cardinal Area.—The area of the ventral valve is narrow, from .5 to .75 mm. in width, and increases only a little after the shell has reached a length of 5 or 6 mm. The delthyrium is completely closed by a convex deltidium. Strong teeth bound the edges of the delthyrium. The dorsal area is about one third the width of that on the

ventral valve. There is a convex chilidium, at the apex of which is the minute anal opening. The inner opening of the anal tube is at the anterior base of the cardinal process, just in front of the point where it bifurcates. The cardinal process in the young stages is wider than long, projects little beyond the hinge line, and is divided once. In the adult it is longer than wide, deeply bifurcated in front and quadrifid on the posterior face. On each side of it is a dental socket which is bounded posteriorly by a slightly developed lamella.

Muscle Scars. — In the dorsal valve there are two pairs of small adductor scars, separated by a thin median septum which extends half way to the front of the valve.

In the ventral valve there are two small adductor scars and in front of them two larger diductor impressions. The scars are not strongly marked in either valve.



FIG. 28. *Rhipidomella vanuxemi* Hall: A ventral valve showing the comparatively large number of striae at a very early stage, and the smallness of the ne-pionic shell. $\times 16$.

FIG. 29. The same species. Outline showing relative convexity of valves of a shell .58 mm. in length. Pedicel valve above. $\times 16$.

Rhipidomella vanuxemi Hall.

Hall, Pal. N. Y., 1867, pp. 40, 47, pl. 5, fig. 6, pl. 6, fig. 3.

There are about 150 shells belonging to this species in the collection. Nearly all the small shells and many of the larger ones retain both valves in their proper relations. The large ones are not well preserved and the largest one which retains its form with sufficient completeness to be measured, is only 15 mm. in length, while there are fragments of larger ones, some indicating a shell of more than twice that size. The larger shells are, however, rare. The smallest shell is .42 mm. in length and .61 mm. wide.

The largest shell of this species, figured by Hall, is 27 mm. long and 32 mm. wide. The smallest, 13.5×15 mm.

Ne-pionic Stage. — The non-plicate shell in this species is extremely small, varying from .10 to .25 mm. in length. Both valves are convex, without fold or sinus. The outline is subcircular, the length and width nearly equal, and the hinge arcuate (Figs. 28, 29).

Changes During Development.

Outline. — In the early neanic stages the shell is wider than long and the frontal and posterior margins are nearly parallel, which gives the shell a pronounced transverse appearance. The index is from

1.30 to 1.40. In later neanic stages the length becomes more nearly equal to the width and a subcircular form is produced in the adult. The index is then 1.05 to 1.15. In the early neanic stages the width of the hinge is from .75 to .80 of the greatest width below. This proportion decreases rapidly and, in a specimen 3 mm. long the hinge is only .40 to .50 of the width below. This latter ratio is maintained throughout the succeeding growth stages.

Convexity of Valves — The very young individuals, less than one millimeter in length, have the ventral valve slightly deeper than the opposite one, and specimens three or four mm. in length sometimes have the ventral valve twice as deep as the dorsal. In later stages the two valves become about equal in convexity and individuals above 10 or 12 mm. in length, at which stage the ventral valve is nearly flat in front, have the dorsal valve a little deeper than the ventral, reversing the relative convexity of the early stages.

With the first pair of plications a shallow sinus appears on the dorsal valve. It becomes broad and poorly defined in later neanic stages, and is hardly perceptible on the front of a specimen 12 mm. in length.

Striæ. — The smallest individual in the collection has eight striæ on the dorsal valve and seven on the ventral. On the dorsal valve, the middle pair bound the sinus and, since they are the longest, are evidently the first to appear. Outside of these the other six striæ seem to have appeared at about the same time. On the ventral valve there is a median striation and three on each side of it. In the next stage observed there are twelve striæ on the dorsal valve. Two of the new striæ have been added on the lateral margins and two are implanted in the sinus between the first pair. From this stage striæ are added rapidly by both implantation and bifurcation. A shell 1.33 mm. long and 1.75 mm. wide has 20 striæ, ten of which are primary. At a length of 2.1 mm. there are 25 striæ; at 5 mm., 50, and at 11.6, 80. This was the largest specimen on which the striæ were sufficiently well preserved to be counted.

Hinge Development. — In the very youngest neanic stages the cardinal areas are about equal and the beaks diverge at a wide angle. The pedicle opening is shared by both valves, but the opening in the dorsal valve is somewhat modified by the small cardinal process. At a little later stage the cardinal process closes up the opening of the dorsal valve and in adult stages fills a large part of the opening in the ventral area. No traces of a deltidium are preserved on any of the specimens examined.

Inside the beak and umbo of the ventral valve is a thickening due to the deposition of shelly matter while the cardinal area is being added to. It is as wide as the area and striated in the same way. In young specimens this thickening shows as a concave plate at the apex of the delthyrium and might easily be mistaken for a deltidium.

In later neanic and adult stages the ventral beak is incurved, but does not project beyond that of the dorsal valve. The dorsal area remains nearly as wide as that of the opposite valve, but instead of lying at an angle as in the early neanic stages it is in the plane of union of the valves.

After the early neanic stages the teeth and crura are supported by lamellæ. The cardinal process is large and pyramidal, with the two posterior faces roughened for the attachment of muscles. The crura are long and slender, projecting outward and upward into the opposite valve. At the distal ends they are flattened vertically.

Comparison with Other Species.

The ontogeny of *Rhipodomella hybrida* of the Niagara has been worked out by Beecher and Clarke. (*Memoirs N. Y. State Museum*, Vol. I, No. I, 1889, p. 17, pl. I, figs. 13-18.) The two species agree closely in their developmental stages, one species differing only in the earlier assumption of the characters of each stage.

A shell of *R. hybrida* .5 mm. in length and .75 mm. in width has six striæ on the dorsal valve and five on the ventral, while a specimen of *R. vanuxemi* .42 mm. long and .61 mm. wide has eight on the dorsal and seven on the ventral.

Tropidoleptus carinatus Conrad. (Plate VIII.)

Hall, Pal. N. Y., IV, 1867, p. 407, pl. 62, fig. 2, 3.

This well known species is very abundant in the silicified material, and a collection of about seven hundred well-preserved specimens was obtained after hundreds of fragmentary shells had been discarded.

The smallest shell is 1.66 mm. in length and 1.46 mm. in width, the largest, 22 mm. long and 28 mm. wide.

There are many shells showing all gradations between the two. Nearly all the small shells, and many of the adults, retain both valves in their proper relations.

The smallest shell figured by Hall is 4.6 mm. long and 4 mm. wide. The largest is 31 mm. long and 40.4 mm. wide.

Nepionic Shell. — In the nepionic stage the shell is transversely oval to subcircular, with a hinge width less than the width below. Both valves are convex and smooth. The hinge line is somewhat arcuate. In the early part of this stage the shell is distinctly wider than long, but just before the inception of the plications the length and breadth are about equal. Some of the dimensions are: $.14 \times .20$ mm., $.57 \times .64$ mm., $.66 \times .70$ mm., $.74 \times .74$ mm.

Changes During Development.

In Outline. — In the earliest neanic stages the shell becomes longer than wide and this form is maintained until the shell reaches a length of from four to seven millimeters, after which the proportions are reversed, and the width exceeds the length in succeeding stages. In the adult condition the shells are usually about one fourth wider than long. The index followed through all stages from the nepionic to the gerontic, shows a double curve. Thus: Nepionic, 1.42, 1.12, 1; neanic, .87, .81, .79, .85, .90, 1, 1.12; adult, 1.12, 1.18, 1.25; gerontic, 1.33.

From the early neanic through the adult stages the width of the shell at the hinge equals or exceeds the greatest width below. In these stages the cardinal extremities are usually mucronate. In gerontic stages the width continues to increase without a corresponding growth on the posterior margin, which produces rounded cardinal extremities and gives the shell a transversely elliptical shape.

Convexity of Valves. — Up to a length of from .75 mm. to 1.00 mm. both valves are slightly convex, the pedicle valve somewhat the deeper. At this point, where the plications generally begin the brachial valve becomes slightly concave, and in all later stages, is more or less concave beyond the growth line marking the end of the nepionic shell. In adult shells the dorsal valve is sometimes strongly concave, but is usually only moderately so, or nearly flat. From the earliest plicated stage the median plication of the ventral valve is somewhat stronger than the others and there is a corresponding sinus in the brachial valve. As the older stages are reached, this median



FIG. 30. *Tropidoleptus carinatus* Conrad. Series showing change in relative convexity of valves. $\times 9$.

fold and sinus becomes wider and finally forms a broad arch in the front of the valves.

Plications. — Immediately after the nepionic stage, plications arise on both valves and apparently several are formed simultaneously. On an individual 1.6 mm. in length there are ten plications on the dorsal valve and nine on the ventral. Another individual, of about the same size, has eight on the dorsal and seven on the ventral valve. New plications are added at the sides and are never implanted, nor do they ordinarily increase by bifurcation. In the adult there are from 17 to 21. In young stages the plications are sharp and distinct, but in the adult and senile specimens they are more rounded and become broad and faint in front. Two types of plications are found, one in which they are rounded, while in the other they are more angular and have wider spaces between. Fine concentric striæ are very numerous.

Gerontic Stage. — The senile characters in this species are: hinge width shorter than the width below; strong varices of growth numerous; obliterations of the plications toward the front of the shell. One specimen showing these characters is 22 mm. long, 28 mm. wide, and has a width at the hinge of 16.2 mm. There are 19 plications on the ventral valve, all of which become flattened and obscure beyond a growth line at 12 mm. in front of the beak. In nearly all cases the plications are more completely obliterated on the dorsal than on the ventral valve. A larger specimen from East Bethany shows much the same character. It is 27 mm. long, 36.4 mm. wide, and has a width at the hinge of 22 mm. There are 19 plications, all of which become indistinct beyond a growth line 20 mm. in front of the beak. The shell is thickened and there are numerous strong growth lines near the front.

Other Features: Cardinal Area. — Each valve has a well developed cardinal area which is longitudinally striated. That of the ventral valve is a little wider than the opposite one and has a large triangular to semicircular delthyrium, the apex of which is rounded and encroaches somewhat upon the ventral beak. The cardinal process nearly fills this opening, but there is, at all stages, plenty of room for the emergence of the pedicle, which is probably functional all through life. The large and strong scar of the pedicle muscle also tends to support this view. No deltidial plates are found at any stage.

Muscle Scars. — The scars of none of the muscles show distinctly in either of the valves, except in the older stages. Then the scars of the

diductors become quite clearly defined in the ventral valve. They are large, flabelliform, and extend about half way to the front of the valve. They are limited posteriorly by a pair of ridges which extend outward from the bases of the teeth. Between the two diductors is a low rounded septum, on each side of which is a narrow oval adductor scar. Directly below the posterior ends of the teeth is a fairly deep pedicle muscle scar, often divided by the septum. Posterior to this, inside the beak, there is a continuation of the ventral area, of the same appearance and width as the external portions of the area. It serves to reinforce the umbo, which is encroached upon by the pedicle. This is the striated portion of the interior taken by Hall and Clarke (Pal. N. Y., Vol. VIII, pt. II, p. 302) for the attachment of the pedicle muscle.

In the brachial valve, the muscle scars are not well marked. The adductors are large, flabelliform, with faint radiating ridges dividing each into several parts. They extend over half way to the front of the valve, and a section shows that the shell is thickened, forming a platform for their attachment.

Cardinal Process. — The cardinal process is large and prominent. It extends into the delthyrium of the ventral valve, nearly filling it. The main part of the process is posterior to the hinge line. It is joined in front to the bases of the crura, and between them is a thickening of the shell, forming a platform which slopes down to the floor of the valve. On either side of this platform are the deep dental sockets which are crenulated on their posterior walls. In a large specimen the cardinal process is about 2.5 mm. wide. The posterior face is smooth and rounded, and the lower third is covered by a strong chilidium which also bounds the posterior ends of the dental sockets. The smallest specimen on which the chilidium could be seen was 3.5×2 mm. and the chilidium was .06 mm. in width. On a specimen 6×6 mm. it was .25 mm. wide and on an adult 1.5 mm. wide.

The posterior wall of the cardinal process has, near the top, a narrow rounded sinus and, in the bottom of this sinus, the shell is continued forward and downward until it unites with the platform of the process, thus forming a shelly loop. On either side of this loop is a deep conical hole which extends nearly to the apex of the shell and probably represents the place of attachment of the diductor muscles. Directly in front of the loop is a groove in the platform leading to a minute anal tube which runs through along the middle

line of the process and has its external opening in a pore just at the joint where the chilidium meets the apex of the valve.

Teeth. — In the pedicle valve, in front of the area, and separated from it by grooves, are two strong crenulated teeth which fit into sockets on either side of the platform of the cardinal process. These teeth seem to have practically the same form and position in all stages, but as they fit at such an angle in their sockets that it is almost impossible to separate the valves without breaking them, it is only rarely that a young specimen retains them. They have been seen in no specimens less than two mm. in length.

Septum. — In front of the bases of the crura there arises a rather thick, low, septum, which, about midway of the shell, increases abruptly in height till it reaches nearly to the opposite valve, then falls off less rapidly and terminates at a point which is about one fourth the length of the shell from the anterior margin. From the point where it begins to rise it is thin and sharp. This septum is well developed in young stages. A specimen 2 mm. in length has a septum exactly similar to that of the adult.

Brachidium. — Only a part of the loop has been seen in the present material. One adult specimen has two quite stout lamellæ which extend upward and slightly inward and reach about half way to the highest point of the septum. At their anterior ends they are flattened and turned slightly outward. Near the posterior ends are what appear to be the bases of processes which would have extended outward and upward. Another specimen, 2 mm. in length, shows about the same amount of the loop, but the two lamellæ diverge at a greater angle.

Punctæ. — The shells are very highly punctate, especially toward the front. From the point where the plications begin, up to a length of about three mm., the punctæ are confined principally to the depressions between the plications. There are two rows to each furrow. From that point they are scattered abundantly all over the surface.

The Same Fossil from Other Localities.

Calcified specimens from Ludlowville, Moscow, York, East Bethany and Eighteen Mile Creek, N. Y., were taken for comparison with the specimens in the present collection. Those from Ludlowville, York, and Eighteen Mile Creek resemble closely in size, index, and form, the specimens from Canandaigua Lake. Those from Moscow and

East Bethany are of larger size, have a higher index, and show a greater number of senile individuals.

The individuals from Ludlowville have, in the adult condition, the width of the hinge about equal to the width below, and most of them have the length nearly equal to the width, thus giving a low average index. The lowest index was 1.07 and the highest 1.33. The average of ten adults is 1.17. The largest specimen was 22 mm. long and 25 mm. wide. A single specimen showed, on one margin, two plications which had bifurcated in front of the last growth line. This is an unusual condition, although Hall figures a senile individual which has all the plications of the dorsal valve bifurcated in front. (Pal. N. Y., Vol. IV, pl. 62, Fig. 3*e*.)

The specimens from York are small. The largest one is only 19 mm. long and 22.4 mm. in width. The index, average of ten specimens, is 1.21. The range is 1.09 to 1.29.

In the collection from Eighteen Mile Creek there are specimens from 3.8 mm. by 3.2 mm. up to 20.4 × 25 mm. The index varies from .84 to 1.30, and the average of ten adults is 1.22. The mature specimens retain a neanic character in having the median plication of the ventral valve only a little stronger than the neighboring ones. Many individuals have the strong angular type of plications.

From East Bethany there are numerous specimens ranging from 11 × 13 mm. to 27 × 37 mm. The index varies from 1.13 to 1.44 and the average for thirty-five specimens is 1.27. Of the 510 specimens examined, nineteen per cent. showed senile characters. These individuals are mainly larger than the average adults, but the index has almost identically the same range as in the adults, viz. 1.13 to 1.44 as compared with 1.13 to 1.42. There are in the collection from this place no distinct varieties, but the long forms, 22 × 25 mm., index 1.13, grade by numerous intermediate steps into the wide forms, 19 × 27 mm. index 1.42. The number of plications varies from 17 to 28. There are only a few specimens from Moscow, but they agree in proportion and form with those from East Bethany. The average of the indices is 1.24. The largest specimen is 26 × 32 mm.

The facts would seem to indicate that, while the conditions at Canandaigua Lake were favorable for the production of large numbers of individuals of this species, they were not such as to allow them to reach the maximum development possible before the senile stage of their lives.

Trigeria lepida Hall.

Hall, Pal. N. Y., VIII, Pt. 2, 1893, pl. 50, figs. 36-40.

There are in the collection, about fifteen specimens of *Trigeria lepida*, three of which are adult individuals. The smallest specimen is 1.09 mm. long and .93 mm. wide: the largest is 6.8 mm. long and 6 mm. wide. The largest specimen is smaller than the smallest one figured by Hall. That is 7.8 mm. long and 6.7 mm. wide, while the largest is 11 mm. long and 9.5 mm. wide. According to that author, an adult has from 20 to 25 plications.



FIG. 31. *Trigeria lepida* Hall; young individual, before the inception of plications. $\times 16$.

Description of Smallest Specimen.—The smallest individual is roughly triangular in outline, the rostrate beak, which projects .25 mm. beyond the hinge, forming the apex. The ventral valve is convex and smooth without folds on sinus. The delthyrium is narrow and open. The dorsal valve is convex, nearly as deep as the ventral, and has a deep, narrow median sinus. There are no striae. This valve is oval in outline, and wider than long. The length is .84 mm., width .93 mm.

A narrow form, only a little longer than this, has the following dimensions. Length, ventral valve 1.36 mm., dorsal valve 1.20 mm., width 1 mm. In this stage the form is very suggestive of *Centronella* (Fig. 31).

Changes During Development.

Outline.—The outline changes very little during development, except in the amount of extension of the ventral beak. In the very small specimens, less than 2 mm. in length, the length of the ventral beak, behind the apex of the dorsal valve, is from .23 to .26 of the length of the shell. In older stages the beak is much less prominent. In a specimen 3.4 mm. long the beak is only .19 of the length, at 5.5 mm. long it is .15 and on the largest specimen, 6.8 mm. long, it is only .09 of the length (Fig. 32).

There are, in all stages, both broad and narrow forms. In the broad form, the index is about .85 in the young specimens and .90 in the adults. For the narrow forms it varies from .73 to .80. In the adults of the broad form, the dorsal valve is about as long as wide, and is only a little longer than wide in the narrow form.

Striæ. — A specimen 1.87 mm. long has seven striæ on the ventral valve. The median one is stronger and a little longer than the others. A specimen 3.4 mm. long has 15 striæ and the largest specimen has the same number on the ventral valve and 14 on the dorsal. A smaller specimen, 3.46 mm. long, has 18 striæ on the dorsal valve and another, 5.5 mm. long has 16 striæ on one valve and 17 on the other.

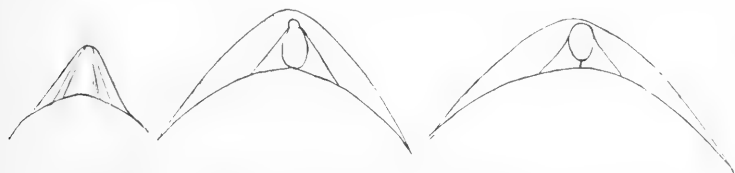


FIG. 32. *Trigeria lepida* Hall; series showing the growth of the deltidial plates and the encroachment of the pedicle upon the ventral beak. $\times 8$.

Deltidial Plates. — None of the specimens less than 3 mm. long, show any traces of deltidial plates. The specimen 3.4 mm. long shows a very narrow scalene triangle on each side of the delthyrium. In the specimen 5.5 mm. long these triangles have become wider at the base, almost uniting. The apex of the ventral beak is encroached upon, thus enlarging the opening posteriorly. In the largest specimen the deltidial plates are still wider at their lower ends and are united for a short distance. The pedicle has encroached still further upon the ventral beak, forming a large oval opening.

Sinus. — The sinus in the dorsal valve is still sharp and distinct in a specimen about 3.5 mm. long, but, on the larger specimens, it is hardly perceptible.

Eunella lincklæni Hall.

Hall, Pal. N. Y., IV, 1867, p. 397, pl. 60, figs. 49-65.

Of this species there are about forty whole specimens retaining both valves and nearly as many separate valves. The smallest specimen is 1.17 mm. long and .84 mm. wide; the largest 19 mm. long and 17 mm. wide. So perfect is the preservation that in many cases a large part of the delicate loop which supported the brachia is preserved and, in at least one case, the loop is entire and as well shown as in the most perfect recent brachiopods of this type.

Description of Smallest Shell. — No stages earlier than that represented by the smallest shell in the collection could be made out. At that stage the shell is about three-fourths as wide as long, and the two

valves are subequally convex, the ventral valve a little the deeper. The dorsal valve is elongate oval, .87 mm. long and .84 mm. wide, while the ventral valve has a narrow rostrate beak which extends .2 mm. back beyond the hinge. The delthyrium is large, triangular and without deltidial plates (Fig. 33). The loop of this specimen can not be determined as only a short portion is retained. On the dorsal beak the first punctæ can be seen and their arrangement agrees with that seen on the nepionic shell of *Terebratulina septentrionalis*.¹

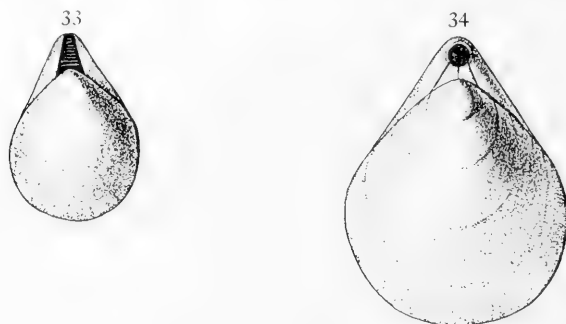


FIG. 33. *Eunella linckleri* Hall. Young specimen with open delthyrium. $\times 16$.

FIG. 34. The same species. An adult, showing several growth stages. $\times 3$.

The first pair of punctæ are .072 mm. from the beak and in front of them, on the median line, and .109 mm. from the beak, is a third one. Beyond this they are scattered sparingly over the surface for a short distance but toward the front of the shell they become very numerous.

Changes During Development.

Outline. — The outline changes very little during the various stages. There are both broad and narrow forms. The index of the ventral valve varies from .68 to .88 in young specimens and from .76 to .92 in adults. The dorsal valves of adults of the broad type are nearly circular, while the index of the same valves in the narrow form is from .71 to .88.

Convexity of Valves. — In young stages the ventral valve is slightly deeper than the dorsal, but in the adult the convexity of the valves is often reversed. The ventral beak extends straight beyond the hinge in young individuals. In adults the umbo is incurved and the apex of the beak is truncated by the pedicle opening.

¹E. S. Morse, *Memoirs Boston Soc. Nat. Hist.*, Vol. V. No. 8, 1902, pl. 62, fig. 15, also *Mem. Bos. Soc. Nat. Hist.*, Vol. II, pt. 1, No. 2, pl. 1, fig. 3.

Pedicle Opening. — The deltidial plates of very young individuals first appear as narrow pieces on either border of the delthyrium and begin to coalesce along the median line where the specimen is about 3 mm. in length. At this same stage the pedicle begins to encroach upon the ventral beak. In adults the pedicle opening is rather large and circular, and there is a cylindrical tube extending from the opening forward into the umbonal cavity. The deltidial plates are strong, convex and united along the median line. The dorsal beak is somewhat rostrate and extends into the anterior end of the delthyrium.

Muscle Scars. — The scars of the muscles are not deeply impressed. In the dorsal valve there are two diverging raised lines which extend about one third the distance to the front. Between them is a longer median septum which bifurcates at its anterior end. Between the diverging lines of the posterior set are two oval adductor scars which, in some specimens, are fairly plain. Outside of them are two larger anterior adductor muscle scars whose limits are faint.

In the ventral valve under the umbo there is a large triangular pedicle muscle scar. The adductor scars are narrow and elongate. The limits of the diductors could not be made out.

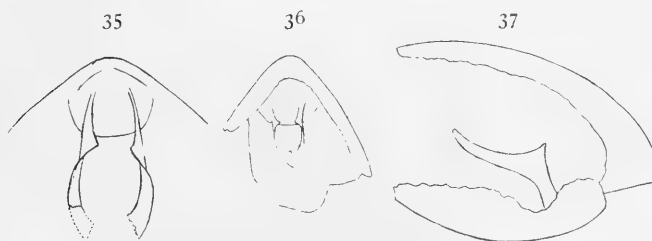


FIG. 35. *Eumella tinckleri* Hall; part of the loop of an adult specimen. $\times 8$.

FIG. 36. Centronelliform stage of the loop. $\times 8$.

FIG. 37. Side view of specimen shown in Fig. 36; shell broken away to show the loop. $\times 16$.

Brachidium. — The smallest specimen retaining the brachidium, and the only one in which the loop is complete, is about 4 mm. in length. The loop extends about half the distance to the front of the valve. The primary lamellæ run sharply upward and forward and the anterior lamellæ run about parallel to the floor of the valve, meeting in the front in an acute angle. As the two lamellæ approach each other they become wider and, when they join, there is also a point directed backward. This is evidently an immature loop, and differs much from that of the adult. It agrees with the centronelliform stage

as described by Beecher and Schuchert. (*Proceedings Biol. Soc. Wash.*, Vol. VIII, p. 73, pl. X, fig. 1.) This is the second genus of brachiopods in which this stage of the loop has been observed and its presence serves to confirm the view expressed in the paper referred to, that the *Centronella* form of loop is a primitive loop for this superfamily of brachiopods. It differs slightly from the loop of *Dialasma turgida* (*Loc. cit.*, pl. X, fig. 1) in that the lamellæ are narrower and the angle in front is not so acuminate.

***Cyrtina hamiltonensis* Hall.** (Plate V, Row 6.)

Hall, Pal. N. Y., 1867, p. 268, pl. 27, figs. 1-4, pl. 44, figs. 26-33, 38-52.

Of this species there are about one hundred specimens in the collection, most of them immature individuals. The smallest shell is .53 mm. long and the width is the same. The largest is 9.13 mm. long and 13.33 mm. wide.

Nepionic Shell.—The smallest individual in the collection represents the species in the nepionic stage. The shell is nearly circular in



FIG. 38. *Cyrtina hamiltonensis* Hall; outline of the smallest specimen. $\times 28$.

FIG. 39. A larger specimen; profile. $\times 16$.

FIG. 40. The same; outline. $\times 16$.

FIG. 41. A slightly older individual, showing the rapid change in the relative convexity of the valves. $\times 16$.

outline and the length and breadth are the same, .53 mm. The hinge line is short, .32 mm., and nearly straight. The ventral valve has a high cardinal area which is almost entirely occupied by a large pedicle opening. The dorsal beak is erect and the space below it is also occupied by

the pedicle opening. Both valves are convex, the ventral only a trifle more so than the dorsal. No trace of the fold or sinus appears at this stage.

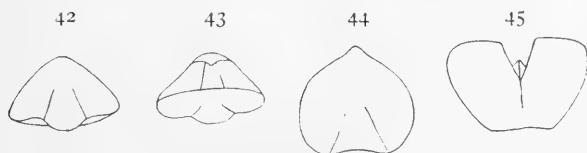
Changes During Development.

In Outline.—Specimens less than 1 mm. in length are usually but little wider than long. The index varies in neanic stages from 1.33 to 1.50 and in the adult stages from 1.45 to 1.75. The width at the hinge is, in all stages, usually a little less than the greatest width below, sometimes equals, but very rarely exceeds it.

Convexity of Valves.—Specimens in the nepionic and earliest neanic stages, with a shell .75 mm. or less in length have the valves

of nearly equal convexity. The ventral area is curved and inclined backward so that the ventral beak projects beyond the dorsal. In stages but little later, when the shell is slightly over 1 mm. in length, the ventral valve is four or five times as deep as the dorsal. At this time the ventral area is high, and curved, and the beak is a little anterior to the hinge line. In more mature shells the area on the ventral valve may become flat and inclined forward or may be curved and inclined backward, as in the nepionic stage. In some individuals this curvature and backward tilting of the area become very strong. It seems to be a senile character as specimens in which it is very pronounced show several strong growth lines.

The height of the cardinal area is variable, but in proportion to the width at the hinge, it is decidedly less in very young stages than in older ones. In two specimens less than 1 mm. on the hinge the height was .26 of the hinge width. In a specimen 1.02×1.3 mm. this index was .36; in one 3.33×5.13 mm., it was .58; and in-



FIGS. 42-44. *Cyrtina hamiltonensis* Hall. Anterior, cardinal and dorsal views of a specimen in the stage before the inception of plications. $\times 16$.

FIG. 45. The same species. Section through the ventral valve of an adult, showing medium septum and the peculiar double tube at the bottom of the groove formed by the dental lamelle. $\times 8$.

creased to .69 in an individual 4.43×6.86 . This rate of increase does not hold for all specimens, however, and the curvature of the area prevents the accurate determination of this index on the majority of cases. In the largest specimen in the collection which has a flat area, the index is .55. The specimen is 7×12.4 mm. and the area is 6.8 mm. high.

Plications. — When the shell has reached a length of from .45 to .60 mm. a sinus is formed in the ventral valve and very soon after its initiation a fold is produced in the opposite shell. This stage, in which there is no other ornamentation than the fold and sinus, continues for some time. The largest specimen showing this state is 1.5 mm. long and 2.26 mm. wide. Shells at this period are almost globular and are difficult to tell from the young of *Ambocalia umbonata*, unless carefully examined.

The plications are introduced in pairs on the lateral margins, each pair coming in outside the older ones. The plications are added on both valves at practically the same time, so that not counting as plications the two ridges which bound the sinus in the ventral valve, nor the fold on the dorsal, there are always the same number on both valves. On a specimen 2.43 mm. long and 3.40 mm. wide, there are two plications on each valve. On one 3.13 mm. long there are 6; on one 3.33 mm. long there are 8; at 4.76 mm. long there are 10; at 7 mm., 12; and at 9.13 mm., 16.

In adults there is a depressed line along the middle of the fold, giving it a flattened and, sometimes, divided appearance.

Pedicle Opening.—In the nepionic stage the pedicle opening is large and oval and is shared by both valves. In early neanic stages it becomes restricted to the ventral valve, in which there is a narrow triangular delthyrium bounded by dental lamellæ which unite with a median septum a short distance in front of the area. This spondylium is visible at the beak of a specimen less than 1 mm. in length and continues to grow throughout life. In adult specimens it reaches down about two thirds of the distance from the apex to the cardinal line. The median septum projects behind the point where the dental lamellæ are joined to it and from its posterior edge two thin partitions run diagonally forward and join the dental lamellæ, thus forming a V-shaped ridge in the bottom of the spondylium. There are two triangular cavities between these partitions, the dental lamellæ and the median septum, but they do not appear to have an opening on the external surface of the shell at any stage (Fig. 45).

In the neanic stage at which there are two plications on each valve, *i. e.*, when the shell is from 1.6 to 2.4 mm. long, narrow deltidial plates are formed, which, at a later stage, when the shell is from 3.0 to 3.5 mm. in length, coalesce along the median line and continue to cover the lower part of the delthyrium throughout life. A pedicle opening is left at the apex.

Comparison with Specimens from Other Localities.

The mature specimens from Canandaigua Lake are from 6 to 9 mm. in length and 8 to 12 mm. in width, and bear from 8 to 12 plications. The hinge width is generally less than the greatest width, and the ventral area is inclined either backward or forward. For comparison with this material, specimens from York, Livingston Co., and Eighteen

Mile Creek, N. Y., Thedford, Ontario, and Alpena, Michigan, were selected from the rich collections of the Peabody Museum.

With the other New York specimens the present material agrees in general size and in number of plications. The largest of the specimens from York measured 7.4 by 12 mm. and had 10 plications. The height of the area of this specimen was .62 of the width of the hinge. All the specimens from this locality had either 8 or 10 plications. The hinge width was equal to the width below, shorter, or, in one case, slightly larger. A dorsal beak showed two stages of growth, the smaller of which had only the fold developed and the larger had four plications. In the smallest specimen, 4×6.2 mm., the deltidial plates had coalesced over the lower third of the delthyrium.

The Eighteen Mile Creek specimens showed much the same characters. The largest specimen was 7×10 mm. and had 8 plications. The smallest was 3.8×5.4 mm. and had four plications. On this specimen the deltidial plates were still separated. The width at the hinge is always equal to, or less than, that below.

About 200 well-preserved specimens from Thedford were examined. Most of them are larger than the average of those from New York.¹ The smallest specimen is 6.4×10 mm. and the largest is 11×22.4 mm., with 22 plications. The majority have from 12 to 18 plications. In the smallest specimens the width of the hinge is about equal to the greatest width below. In the larger ones it is almost invariably greater, and the shell is frequently auriculate at the cardinal extremities.

The areas of all the shells are inclined backwards and frequently strongly curved and distorted. In no case was there any filling of the pedicle opening by testaceous matter, even in the oldest shells.

The shells from Alpena, Mich., resemble the Ontario specimens more than they do those from New York State. They are large, 7×12 to 9.6×15.4 mm., and have from 10 to 16 plications. The hinge width always equals or exceeds the width below, but the specimens in the collection are not auriculate.

¹ Hall mentions this in Vol. IV, Pal. N. Y., p. 867, p. 269. He says: "The specimens of the Hamilton group of New York are usually small, measuring about half an inch in length and breadth; the largest one seen by me being a little more than eleven-sixteenths of an inch in width and about eleven-sixteenths in length from the apex to front of valve. In some Canadian specimens the length and width are about seven-eighths of an inch."

Comparison with Other Species.

The earliest known species of *Cyrtina* in American faunas is the *C. pyramidalis* Hall, a rare shell from the Niagara. Owing to the very limited number of specimens, little is known of its variation, but the figures in Vol. II, Pal. N. Y., show a shell which is, in some respects, more primitive than *C. hamiltonensis*. It is smaller and there are fewer plications. The cardinal area is high, as compared with the width at the hinge, flat, and has a narrow delthyrium with convex deltidial plates. The length is 7.8 mm., the width at the hinge, which is the greatest width of the shell, is 11 mm., and the height of the cardinal area is 7 mm. There are 10 plications.

The next species in point of time, is *C. dalmani* Hall from the Lower Helderberg. This is an extremely variable species, but the average specimen is smaller and has fewer plications than *C. hamiltonensis*. The smallest specimen figured by Hall is 2.4 by 4.3 mm. and has four plications. The largest is 8 × 16 and has 14 plications. An average specimen is 6 × 10.5 mm. with 8 plications. This species shows more advanced characters than *C. pyramidalis* in having the mesial lobe flat, sometimes with a depressed line, and in the greater number of plications.

Cyrtina biplicata Hall from the Schoharie grit and *C. crassa* Hall from the Corniferous, are two large shells which retain neanic characters. *C. biplicata* does not develop any plications except those which bound the sinus, but has the surface covered with fine striæ. *C. crassa* has only four plications on each side of the fold.

C. hamiltonensis, as it occurs in the Schoharie, is small, about 8 × 11 mm. and has only six plications.

Spirifer mucronatus Conrad. (Plate VI, Rows 1 and 2.)

Hall, Pal. N. Y., IV, 1867, p. 216, pl. 34, figs. 1 to 32.

There are about 300 specimens of this species in this collection from which a series can be chosen which represents the shell in all stages of growth between a size of 1.06 by 1.48 mm. and 14.8 by 52 mm.

Protegium. — On the beak of a well preserved dorsal valve 2 mm. in length was the impression of the initial shell. It was circular, somewhat convex, with a curved hinge. The diameter was 11 mm. Around it were two concentric growth lines marking later growth stages. One indicated a shell .25 mm. long and .27 mm. wide and the other a shell .27 by .32 mm.

Nepionic Shell. — In the nepionic stage, the shell is oval in outline and broader than long. Both valves are convex, the ventral a little deeper. The hinge width is less than the greatest width below. The surface of the shell is smooth with no fold, sinus or plications. On one specimen the nepionic shell is .45 mm. long and .73 mm. wide. On another it is .38 mm. long and on a third it is .60 mm. in length.



FIG. 46. *Spirifer mucronatus* Conrad; outline of protegulum and shell in nepionic stage; taken from a dorsal valve. $\times 28$.

FIG. 47. *Spirifer mucronatus* Conrad. A ventral valve showing the shell in the stage in which there are only two plications beside the ridges bounding the sinus. $\times 3$.

FIG. 48. The same species. Ventral valve at the stage when there are six plications beside those bounding the sinus. $\times 2$.

Neanic Stages. — In the earliest neanic stages a sinus is developed in the ventral valve, bounded by two strong ridges which are the first plications. Following this, a fold is formed in the dorsal valve and plications are added on the margins in pairs, each pair coming in outside the older ones. The later plications added do not reach to the beaks.

The smallest shell in the series, a ventral valve 1.06 mm. long and 1.48 mm. wide, has the median sinus, the two plications bounding it, and two very short lateral plications. The delthyrium is wide and without deltidial plates.

The ventral valve, in early neanic stages, is about twice as deep as the dorsal.

When the shell is about 2 mm. in length an impressed line appears on the fold of the dorsal valve and, soon after, a faint fold or plication appears in the ventral sinus and grows constantly stronger throughout life.

In an early neanic stage the hinge width becomes the greatest width of the shell and the cardinal extremities soon become acuminate. Specimens up to five or six mm. in width do not have the strong mucronations but nearly all adolescent shells above that size have them. In one series measured the index increased constantly from 1.30 in a shell 1.73 mm. in length to 3.5 in an adult 14.8 mm. in length. This last shell did not have the mucronate cardinal extremities.

Adult. — In the adult state the valves are about equally convex and bear from 10 to 26 pairs of plications. The cardinal extremities are acute, but are not prolonged into the spiniform extremities as in the neanic stages. The shells are of a wide type, with a high index, 2.25 to 3.00. The front is regularly curved. The fold is broad and marked by a deeply impressed line and there is a distinct plication in the sinus. The surface is covered with concentric lamellæ of growth which, in old specimens, are so prolonged on the plications as to give the surface a spinose character. Three individuals, or one per cent. of the whole, show senile characters in the thickening of the shell, the spinose surface, and great number of growth lines toward the front.

Comparison with the Same Species from Other Localities.

Specimens from Cherry Valley, Otsego Co., have about the same form as those from the present material. The cardinal extremities are acute, but not far extended, and the front is regularly curved. The specimens are large; 13 to 17 mm. long and 40 to 58 mm. wide, and have a relatively small number of plications, 24 to 40. The index varies from 2.35 to 4.46. The specimens do not show the depressed line in the fold or the plications in the ventral sinus. Specimens from Worcester, Otsego Co., from the collection of Miss Grace Goodenough, show two forms, one short, wide form like the specimens from Canandaigua Lake, and a long form with a very low index and rather blunt cardinal extremities. Specimens of both types show the depressed line in the dorsal fold and most of them have the plications in the sinus of the ventral valve. A small specimen of the short type is 6 mm. long and 29 mm. wide and has 32 plications. A large specimen of the same type is 19 by 66 mm. with 50 plications. The index varies from 2.81 to 4.83 among individuals of this form.

A large specimen of long form is 28 mm. long and 35 mm. wide, and has 40 plications, while a small individual is 9 by 12.5 mm. with 26 plications. The index in this type of shell varies from 1.25 to 1.60.

The specimens from East Bethany belong to the same type as those from the silicified material and have about the same range in size and in number of plications. The index varies from 2.00 to 3.69; the plications from 14 to 40; the length from 7.5 to 19; and the width from 15 to 60 mm. All of the 62 specimens from this locality have

the depressed line in the dorsal fold, but only 25, 40 per cent., have a plication or raised line in the bottom of the sinus. Four specimens show senile characters.

From Eighteen Mile Creek there are three well-marked varieties. One, the most common, is rather long, nearly semicircular in form, and has very much prolonged cardinal extremities, and the front regularly curved. The third variety is long and comparatively narrow, with rounded cardinal extremities. This form is rather rare and is produced by the stopping of growth along the hinge at the end of the neanic or in early ephelic stages. In the neanic stages the shell is acuminate at the cardinal extremities.

The index of shells of the first form, when they are so preserved as to retain their cardinal extremities, is very high. One specimen, 11 mm. long, has an index of 4.45. With the spiniform extremities the width is 49 mm. Without them, it is 20 mm. As most of the specimens had at least a part of each cardinal extremity broken off, the index in this variety varies from 1.80 to 3.00 in ordinary specimens. The plications number from 16 to 44, those shells with the highest index having the greatest number of plications.

The second variety includes shells with an index of 2.00 to 3.00, 7 to 13 mm. long and 13 to 39 mm. wide. They carry from 16 to 32 plications. This is the Canandaigua Lake type, but the specimens are rather under normal size.

The index in the third variety is from 1.40 to 1.94 and the number of plications from 18 to 30. Only six specimens of this variety were contained in a collection of about 300 shells. Four of the six bore 22 plications each. The largest of these shells is 20.4 by 31 mm., and the smallest 15 by 21 mm. From the growth varices preserved on the shell it can be seen that these shells (in their neanic stages) passed through forms like varieties one and two.

Of the 164 specimens of all three varieties examined, all but six had a depressed line in the fold of the dorsal valve, while only 30, 18 per cent. had the plication in the sinus of the ventral valve. Only six specimens were found which showed strong senile characteristics.

According to Grabau, *S. mucronatus* is common below the Encrinal limestone, but rare above it in the Eighteen Mile Creek section. He mentions a specimen, probably of the first variety, which was 15 mm. long and 100 mm. wide.

From Thedford, Ont., there are in the collections of the Peabody Museum a great number of well-preserved specimens belonging to this species. They can be separated into three well-marked varieties, but there is a great amount of variation within the limits of these varieties.

First and least common is the form very much like the specimens from Canandaigua Lake. It is short but wide. The front is regularly curved and the cardinal extremities, while acute, are not extended into spiniform projections. The dorsal fold has a depressed median line, but there is no corresponding plication in the ventral sinus. The index is from 2.16 to 3.00; length, 6 to 17 mm.; width, 14 to 41 mm.; plications, 18 to 40. This is probably the shell given the varietal name *arkonsis* by Shimer and Grabau,¹ but none of the specimens in the Yale collection show the plication in the sinus of the ventral valve.

In the neanic stages, as shown by the growth lines, this variety is short and rather strongly mucronate.

A second variety is the long form, which is straight in front and with the sides straight or slightly curved. The cardinal angles are acute and the extremities somewhat prolonged in well preserved specimens. This type is fairly common. The index is low, 1.60 to 2.00. The length from 15 to 20 mm., the width from 25 to 35 mm., and there are 18 to 30 plications, usually about 22 or 24 on each valve.

The third and most common form is nearly semicircular in outline, with the cardinal extremities somewhat produced. The shell has a tendency to become somewhat robust, especially in the later stages. The index varies from 1.85 to 2.92. The more common range is from 2.05 to 2.30. There are usually from 22 to 30 plications, though there may be as few as 14 on small individuals and as many as 40 on large ones. In the adult, some have the depressed line in the fold of the dorsal valve and some do not. This is the variety *thedfordensis* of Shimer and Grabau (*loc. cit.*).

The index here given is too low, as the cardinal extremities are so worn and broken in the adult that it is difficult to say exactly what the mature form was. But, judging from the growth lines, it is probable that the extremities were acuminate, not, however, nearly so ex-

¹ "The Hamilton group of Thedford, Ont., Shimer and Grabau." Bull. Geol. Soc. Am., Vol. 13, pp. 149-186, June, 1902.

tended as some of the Eighteen Mile Creek specimens. In the earlier stages the shells were more mucronate. The neanic stages of all three varieties seem to have been about the same, as all show the short shell, the extended cardinal extremities and the depressed line in the dorsal fold. In the first variety, the later neanic and adult growth has been transverse, while in the other two forms it has been longitudinal as well. All these varieties contain specimens which present senile conditions. Out of 680 specimens examined 20 per cent. (136 specimens) showed senile characters. These characters are most commonly expressed at the Thedford locality by strong varices of growth near the anterior margin of the shell which increase the depth of the valves and produce a broad flat anterior face in place of the sharp junction of the valves in the normal shell. The shells also become thickened, and lateral growth stops.

Of 400 adult specimens, 182 showed a trace of the depressed line in the fold of the dorsal valve, while the remainder, 55 per cent., did not. Of those which showed the depressed line, many had only the faintest trace of it, while others, 7 per cent. of the whole, had a well marked sinus along the median line of the fold. To this class belong all of variety one, the short wide form, and a few of the third variety. None of the specimens show the plication in the sinus of the ventral valve.

***Delthyris consobrinus* d'Orbigny.**

Hall, Pal. N. Y., IV, 1867, pl. 35, figs. 15-33.

There are about 50 specimens in the collection belonging to this species. They are all small for the species. The largest is 9.4 mm. long and 17.4 mm. wide, and the smallest is 1.28 mm. by 1.38 mm. The specimen figured by Hall as an individual of average size is 15 mm. long and 25 mm. wide, while the largest figured by him is 17×32 mm. and the smallest 6×10.6 mm.

The developmental changes are about the same as in *Spirifer mucronatus*, the only striking difference being that the valves are subequally convex in the early neanic stages and the ventral valve becomes much deeper than the dorsal in the mature shell, while in *S. mucronatus* the reverse is the case.

Nepionic Stage.—In the nepionic stage the shell is biconvex and oval in outline. It is broader than long, the hinge width less than the width below. The surface is smooth. The length is from .35 to .50 mm. In one specimen the dimensions are $.41 \times .53$ mm.

Neanic Stages. — As in *S. mucronatus* and *Cyrtina hamiltonensis* the first change from the nepionic shell is the formation of a ventral sinus, which is bounded by two strong ridges. This is followed by the formation of a fold and two plications on the dorsal valve. Plications are then introduced, in pairs, on the lateral margins. With the appearance

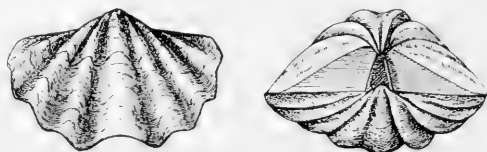


FIG. 49. *Spirifer crispus* (Hisinger). Dorsal and cardinal views of a specimen from Waldron, Ind. $\times 2$. Compare with Fig. 48.

of the first pair of plications the hinge width becomes greater than the width below and, during the later stages, the shells are mucronate. The index varies from 1.13 in a shell .44 mm. long with 4 plications, to 2.30 in a shell 6 mm. long and bearing 12 plications. The adults have from 10 to 14 strong plications. Unfortunately, the deltidial plates are so completely broken away in all the specimens as to make it impossible to learn anything of their manner of development.

It is interesting to note that these transversely elongated Devonian Spirifers pass through, in their early neanic stages, forms which correspond to the adult condition of certain Niagara species. The adult of *S. crispus*, with a fold and eight plications on the dorsal valve, the ventral valve deeper than the dorsal, and a hinge width nearly equal to the width below, corresponds

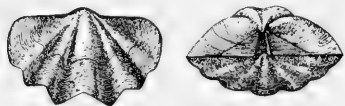


FIG. 50. The same species. Dorsal and cardinal views of a specimen from Gotland. $\times 4$.

FIGS. 49 and 50 are from specimens in the Baron de Bayet collection, now the property of the Carnegie Museum.

very closely in these particulars, and in its index, with a specimen of *S. mucronatus* about 2 mm. long and, except in the number of plications, with a specimen of *D. consobrinus* one mm. long (Figs. 49, 50).

Spirifer radiatus, with no plications, the width only one seventh greater than the length, and the width at the hinge less than the width below, corresponds to a still earlier stage in the development of these species.

SUMMARY.

The foregoing descriptions show that the general deductions which have been previously drawn as to the character of the nepionic shell, the development of the pedicle tube and the deltidial plates, and the acquirement of surface characters, hold good in the families here studied for the first time. Other general facts will be noted under the families.

Centronellidæ. — The shape of *Trigleria lepida* in the nepionic stage is almost exactly that of adult *Centronella*, and thus another bit of evidence is added to that afforded by the loop, showing its relation to the Centronellidæ rather than to the Terebratulidæ. Going back to the very earliest stage, before the development of the dorsal sinus, the shell has characters common to the superfamily, that is, a biconvex shell with the ventral beak extended beyond that of the dorsal valve.

Terebratulidæ. — *Eunella*, in its early stages, is a rather simple, generalized type of shell, not differing greatly from the very youngest stage of *Trigleria*, but the development of its loop shows progress beyond the centronelliform stage. The position of the first three punctæ, which is the same as that in the recent genus *Terebratulina*, is interesting.

Terebratellidæ. — The evidence that *Tropidoleptus* belongs to this family has not been strengthened or diminished by the present studies. It still rests on the form of the loop as described by Hall, and later verified by Hall and Clarke. The development is similar to that of the Strophomenidæ, and the articulation is like that in *Chonetes*. No deltidial plates are developed, and the pedicle is probably functional throughout life. The cardinal process is very large, and of a peculiar type, quite different from that of any of the Strophomenidæ.

Spiriferidæ. — The marked difference in shape and relative convexity of valves of *Cyrtina* in the early neanic stage, from *Spirifer* and *Delthyris* in the same stage, together with the geological range, would seem to indicate that, while both may be derived from the same ancestral stock, *Cyrtina* is not a modified *Spirifer*. *Delthyris*, *Spirifer*, *Ambocælia* and *Cyrtina* all start out with an inequivalve nepionic shell and a pedicle opening shared by both valves. But with the first changes in later nepionic and early neanic stages, when the fold and sinus appear, *Cyrtina* and *Ambocælia* become strongly inequivalve, while in *Spirifer* and *Delthyris* the valves retain for a short time their equality of convexity. In other words, the generic habit is assumed immediately after leaving the form that is common to all the members of the superfamily, and *Cyrtina* passes through no *Spirifer*-like stage.

Spirifer and *Delthyris* are so exactly alike in their external form in the youngest neanic stages that it is impossible to separate them.

Strophomenidæ. — The biconvex nepionic shells of *Stropheodonta*, with a median dorsal fold and ventral sinus (which may or may not be present) and the similar nepionic shells of *Chonetes* indicate a possible common origin in some shell whose external form resembled *Triplecia*, though probably not in that genus, which thus far has not been found below the Califerous, while *Rafinesquina*, which would seem to be the immediate ancestor of *Stropheodonta*, extends into the Chazy and probably lower, without any marked change in form. The early neanic stages of *Stropheodonta*, before the appearance of the crenulations on the hinge margin, are very similar to the adult *Rafinesquina*.

An interesting feature in the development of *Stropheodonta* is the marked mucronation of the cardinal extremities of the adolescent specimens. This mucronation disappears to a greater or less extent in the older stages. This same thing is noticed in *Spirifer*, and there many of the adults retain the mucronate forms, but they are only a phase in the life of the genus. In the ontogeny the outline changes from rounded forms in the nepionic and early neanic stages, though a mucronate form in the later neanic, and back to a rounded form in the adult or senile condition. The same thing occurs in the phylogeny of *Spirifer*, at least, for there are Niagara species with rounded cardinal extremities, then a great development of the mucronate types in the Lower and Middle Devonian, and a return to the rounded forms in the Carboniferous. A similar change is seen in *Platystrophia*.

The difference between the varieties *pectenacea* and *arctistriatus* of *Orthothetes chemungensis* is a good example of the effect of acceleration in the development of certain characters. The steps in the development of the two are exactly the same, but because the striæ are introduced at an earlier stage on one than on the other, the shells differ greatly in appearance.

Productidæ. — The facts in the development of *Chonetes* do not seem to support the idea put forward by Hall and Clarke that *Chonetes* might be descended from *Plectambonites*, a shell which in many respects much resembles *Chonetes*. The early neanic stages have an outline which is much the same as that of *Rafinesquina* and *Stropheodonta*. The resemblance of the nepionic shell to *Triplecia* has already been referred to, and this, with the other characters, relates the shell to the *Strophomenidæ*. It is clearly a transition form between the latter family and the *Productidæ*.

PART II. A STUDY OF A HAMILTON FAUNULE FROM
CANANDAIGUA LAKE, N. Y.

INTRODUCTION.

The material on which the preceding studies were based, was, as is stated in the introduction to part I, obtained from a clayey limestone by etching with hydrochloric acid. The outcrop from which the blocks were taken is in a ravine on the west side of Canandaigua Lake, New York, where the silicified fossils occur in several layers, but all within the seventy-five feet above the "Encrinal" limestone of that region.

Sixty-five pounds of the limestone, when treated with acid, yielded about 15,000 shells which were sufficiently perfect to be saved for making up collections, and there was fully as much fragmentary material. In most cases the two valves of the shells are separated, but even taking that fact into consideration, the material must represent the remains of at least 10,000 individuals. From the vast number of the shells, it is evident that they could not have lived contemporaneously in the small space which contains their remains, but the rock must represent the accumulated shells of many years.

As the method used in obtaining the material from the matrix eliminates all the collector's personal equation, all the minute specimens are detected, and all individuals of each species saved. Thus the collection gives a very accurate idea of the fauna existing in the region at the time the rock was being deposited. It cannot, however, be taken as absolutely accurate, as there probably existed species which were not preserved and it is also possible that a larger quantity of the rock might have afforded a greater variety of forms.

The object of this part of the paper is to study this faunule in comparison with the other faunas of the New York-Ontario province, and to give an annotated faunal list.

Conditions of Sedimentation.

The rock is fine grained and contains much very fine clay. In some cases this clay is evenly distributed throughout the layer and is cemented by the lime. In that case the action of the acid is free and as a result the fossils are easily separated from the residue of fine clay by washing. Other layers have an inch or more of almost pure clay

at the top and bottom, and such layers require constant scrubbing and breaking to allow the acid to act. The fossils seem equally well silicified in both, but are not obtained in perfect condition from the latter owing to the mechanical difficulties. The lithologic character of the rock indicates rather shallow water and a sufficient distance from the shore line to prevent a mixture of sand or gravel. The fossils themselves show that their habitat was free from any violent wave action or strong currents. This is indicated both by the state of preservation, which is remarkably fine, and the presence of large numbers of species and individuals of Bryozoa. Large fronds of the delicate species like those of the Fenestellidæ are often found and such delicate spines as those of *Chonetes* and *Strophalosia* are beautifully preserved.

With the exception of the phosphatic linguloid shells and a few of the pelecypods, all kinds of shells are well silicified and by this method of collecting practically everything in the rock is preserved. This accounts for the large number of species found, and for the great number of individuals of species usually called rare. *Pholidops hamiltonensis*, usually not considered abundant, is represented by over 1,500 specimens in the present collection, being second on the list of most common species. By far the most common one is *Chonetes scitulus*, of which about 3,500 specimens have been picked out. Another feature is the abundance of ostracods, of which there are above 15 species, 11 of which have been identified so far.

New species, with the exception of a new *Chonetes*, are confined to rare genera, and will not be described at present.

LIST OF SPECIES.

Anthozoa-Actinozoa :

| | |
|---|----------------------------------|
| <i>Heliophyllum halli</i> , R. ¹ | <i>Ceratopora dichotoma</i> , c. |
| <i>Michelinia stylopora</i> , r. | <i>Ceratopora jacksoni</i> , c. |
| <i>Aulopora serpens</i> , c. | |

Vermes :

| | |
|-----------------------------------|----------------------------------|
| <i>Spirorbis angulatus</i> , R. | <i>Cornulites</i> n. s., r. |
| <i>S. spinulifera</i> , a. | <i>Autodetus lindstrœmi</i> , c. |
| <i>Cornulites hamiltoniæ</i> , c. | <i>Autodetus</i> n. s., R. |

¹ According to the usual custom the abbreviations *R*, *r*, *c*, and *a*, are used here. *R* signifies that the species is very rare; *r*, rare; *c*, common; *a*, abundant.

Bryozoa :

- | | |
|------------------------------------|--|
| <i>Ascodictyum stellatum</i> , c. | <i>P. multiplex</i> , c. |
| <i>Pinacotrypa plana</i> , c. | <i>Rhombopora tortalineae</i> , r. |
| <i>Monotrypa fruticosa</i> , c. | <i>Streblotrypa hamiltonensis</i> , R. |
| <i>Monotrypa</i> , sp. und. c. | <i>Ptilodictya plumea</i> , r. |
| <i>Fenestella emaciata</i> , c. | <i>Cystodicta incisurata</i> , a. |
| <i>Semiscoscinum striatum</i> , R. | <i>Tæniopora exigua</i> , c. |
| <i>Isotrypa</i> , sp. und. R. | <i>Acrogenia prolifera</i> , r. |
| <i>Hemitrypa cribosa</i> ? R. | <i>Lichenalia stellata</i> , c. |
| <i>Polypora fistulipora</i> , r. | <i>Paleschara reticulata</i> , R. |

Brachiopoda :

- | | |
|--------------------------------------|---|
| <i>Lingula</i> , sp. | <i>Crania crenistriata</i> , r. |
| <i>Camarotoechia congregata</i> , R. | <i>Craniella hamiltoniæ</i> , c. |
| <i>C. horsfordi</i> , R. | <i>Strophædonta concava</i> , R. |
| <i>C. sappho</i> , R. | <i>S. demissa</i> , r. |
| <i>Trigleria lepida</i> , r. | <i>S. inæquistriata</i> , c. |
| <i>Eunella linklæni</i> , c. | <i>S. junia</i> , R. |
| <i>Tropidoleptus carinatus</i> , a. | <i>S. perplana</i> , c. |
| <i>Atrypa reticularis</i> , w. | <i>Pholidostrophia iowaensis</i> , c. |
| <i>Cyrtina hamiltonensis</i> , c. | <i>Orthothes chemungensis</i> , c. |
| <i>Spirifer mucronatus</i> , a. | <i>O. chemungensis arctistriatus</i> , c. |
| <i>S. audaculus</i> , r. | <i>O. bellulus</i> , c. |
| <i>S. granulosus</i> , r. | <i>Chonetes coronatus</i> , c. |
| <i>Delthyris consobrinus</i> , c. | <i>C. mucronatus</i> , c. |
| <i>D. sculptis</i> , r. | <i>C. scitulus</i> , a. |
| <i>Reticularia fimbriata</i> , r. | <i>C. robustus</i> , c. |
| <i>Ambocælia umbonata</i> , r. | <i>Strophalosia truncata</i> , c. |
| <i>Nucleospira concinna</i> , r. | <i>Productella spinulicosta</i> , r. |
| <i>Athyris spiriferoides</i> , r. | <i>Rhipidomella penelope</i> , r. |
| <i>Pholidops oblata</i> , c. | <i>R. vanuxemi</i> , c. |
| <i>P. hamiltonensis</i> , a. | |

Pelecypoda :

- | | |
|------------------------------------|--|
| <i>Nuculites oblongatus</i> , R. | <i>Pterineopecten intermedius</i> , R. |
| <i>N. triqueter</i> , R. | <i>P. hermes</i> , R. |
| <i>Nucula corbuliformis</i> , R. | <i>P. regularis</i> , r. |
| <i>Paleoneilo constricta</i> , r. | <i>P. conspectus</i> , R. |
| <i>Conocardium eboraceum</i> , R. | <i>Lyriopecten orbiculatus</i> ? R. |
| <i>Actinopteria decussata</i> , R. | <i>Modiomorpha alata</i> , R. |

| | |
|----------------------------------|--|
| <i>Aviculopecten exacutus</i> r. | <i>Cypricardella bellistriata</i> , r. |
| <i>A. princeps</i> , c. | <i>Cypricardinia indenta</i> , R. |
| <i>A. scabridus</i> , r. | <i>Nyassa arguta</i> ? R. |

Gastropoda :

| | |
|-------------------------------------|------------------------------------|
| <i>Pleurotomaria capilaria</i> , r. | <i>P. thetis</i> , R. |
| <i>Cyclonema hamiltonensis</i> ? R. | <i>Diaphorostoma lineatum</i> , c. |
| <i>Bellerophon leda</i> , r. | <i>Loxonema delphicola</i> , r. |
| <i>Platyceras bucculentum</i> , r. | <i>Hyolithes acilis</i> , r. |
| <i>P. carinatum</i> , r. | <i>Tentaculites bellulus</i> , a. |
| <i>P. symmetricum</i> , c. | <i>Styliola</i> , sp. und. R. |

Cephalopoda :

Orthoceras, sp. und. R.

Crustacea :

| | |
|--------------------------------------|---------------------------------|
| <i>Primetopsis punctilifera</i> ? R. | <i>Beyrichia kolmodini</i> , c. |
| <i>Kirkbya parallela</i> , r. | <i>Haliella retifera</i> , r. |
| <i>Strepula sigmoidalis</i> , c. | <i>Moorea bicornuta</i> , R. |
| <i>Isochilina lineata</i> R. | <i>Proetus roowi</i> , r. |
| <i>I. ? fabacea</i> , R. | <i>Cyphaspis ornatus</i> , R. |
| <i>Primita seminulum</i> r. | <i>Dipleura dekeyi</i> , R. |
| <i>Octonaria stigmata</i> , r. | <i>Phacops rana</i> , c. |
| <i>Ctenobolina papillosa</i> , r. | <i>Cypræus boothi</i> , c. |

DISCUSSION.

For comparison of this faunule with the faunas of other Hamilton outcrops, the species of the Thedford, Ont., Eighteen Mile Creek, Livonia and Cayuga Lake sections were tabulated with the Canandaigua Lake species, as were also certain of those listed in Prosser's work on the Hamilton of eastern New York. In these lists only such fossils were taken as were located by the various authors in some definite stratigraphic horizon. On tabulating the species from various sections in eastern New York, as represented by Prosser, it was found that there was quite a change in the fauna of the upper part of the Hamilton where the eastern boundary of Otsego county was passed, and for that reason the fossils of Chenango and Otsego counties are grouped together and those of Albany county put with those from Schoharie county. None of the lists from the eastern part of the state are complete and any conclusions drawn at this time are of course liable to be upset when studies are made of carefully worked sections. In

addition to Professor Prosser's lists from eastern New York, unpublished lists made by Miss Grace Goodenough from the section at Worcester, Otsego county, and by various members of the Cornell Summer School of Field Geology, from East Berne, Albany county, were incorporated in the table.

The Canandaigua Lake faunule consists of about 115 species which are divided among the classes as follows :

| | |
|------------------|----|
| Crustacea..... | 16 |
| Cephalopoda..... | 1 |
| Gastropoda..... | 8 |
| Pteropoda..... | 3 |
| Pelecypoda..... | 16 |
| Brachiopoda..... | 39 |
| Bryozoa..... | 18 |
| Vermes..... | 6 |
| Anthozoa..... | 5 |

It will at once be seen from the large number of Bryozoa and corals and the small number of pelecypods that this fauna is not closely related to the fauna of the eastern counties.

In Prosser's list from eastern New York there are 131 species which can be definitely located at a certain number of feet from the top or bottom of the Hamilton section of the region. Of this list 66, almost exactly half, are pelecypods, while only 14 per cent. of the species in our faunule belong to that class. It is well known that the more western sections contain a smaller proportion of lamellibranchs than the eastern ones, but our faunule contains less than one would expect from its locality.

The Livonia section, which is only 20 miles to the west, contains 30 per cent. of pelecypods in its list of species, and the Cayuga Lake section about 30 miles east, has 32 per cent. Of course this is a comparison of one faunule with an aggregate of faunules, but it shows that conditions were unfavorable for the development of lamellibranchs at the time these strata were deposited.

Of the 112 species identified, 26 are found in none of the other sections, and so are not useful in comparisons. These are distributed as follows: Vermes, 3; Bryozoa, 6; Brachiopoda, 2; Pelecypoda, 2; Pteropoda, 1; Crustacea, 12. These are all rare or delicate species, usually small and are not apt to be obtained in ordinary collecting from sections. Of the remaining 86 species, 55 occur in that part of the

Cayuga Lake section which lies above the Encrinal limestone, and 52 in the corresponding strata of the Livonia section. The three have 40 species in common. These facts show that our faunule was a very typical one for the region and made up principally of the common species.

There are 34 species which are common to our faunule and the Chenango to Albany counties composite fauna, while there are 60 forms common to the Eighteen Mile Creek section and this faunule. With the fauna of the Thedford section there are only 31 species in common, showing that if this is not an eastern fauna, it is not a western one, but is more nearly allied to the faunas from Eighteen Mile Creek, Livonia and Cayuga Lake.

The present faunule has no dominant species which ally it to any particular faunule of the detailed sections of Cleland or Grabau. The abundance of *Cryptodicta inscissurata* suggested that this faunule might be compared with the *Stictopora* faunules of Grabau and Cleland. That faunule occurs in a one-inch bed of shale just below the Encrinal limestone at Eighteen mile Creek and in the top zone (Zone Y) of Cleland's section at Cayuga Lake. The species may be compared by classes as follows:

STICTOPORA FAUNULE.

| Class. | 18 Mile Creek. | Canandaigua Lake. | Cayuga Lake. |
|---------------------|----------------|-------------------|--------------|
| Anthozoa-Actinozoa. | 1 | 5 | 8 |
| Vermes. | — | 6 | — |
| Bryozoa. | 2 | 18 | 5 |
| Brachiopoda. | 22 | 39 | 33 |
| Pelecypoda. | 5 | 16 | 26 |
| Gastropoda. | 4 | 11 | 5 |
| Cephalopoda. | — | 1 | — |
| Crustacea. | 2 | 16 | 6 |
| Total. | 36 | 112 | 83 |

From this table it is seen that all three faunules are rich in brachiopods and poor in cephalopods and gastropods. In the matter of pelecypods there is not a close agreement, the Cayuga Lake *Stictopora* faunule having a much greater proportion than the others. At Cayuga Lake, 31 per cent. of the number of species are lamellibranchs, while at Canandaigua Lake it is reduced to 14 per cent. and at Eighteen Mile Creek to 13 per cent. The last two agree very closely in this class as in the other mollusca. There are twenty-five species which are common to all these faunules. These are:

| | |
|--------------------------------------|---|
| <i>Cystodicta incisurata</i> , | <i>S. perplana</i> , |
| <i>Tæniopora exigua</i> , | <i>S. iowaënsis</i> , |
| <i>Camarotoechia horsfordi</i> , | <i>Orthotetes chemungensis arctistri-</i> |
| <i>Atrypa reticularis</i> , | <i>atus</i> , |
| <i>Cyrtina hamiltonensis</i> , | <i>Chonetes coronatus</i> , |
| <i>Spirifer audaculus</i> , | <i>C. scitulus</i> , |
| <i>S. mucronatus</i> , | <i>Productella spinulicosta</i> , |
| <i>Ambocælia umbonata</i> , | <i>Rhipidomella vanuxemi</i> , |
| <i>Reticularia fimbriata</i> , | <i>R. penelope</i> , |
| <i>Nucleospira concinna</i> , | <i>Cypricardinia identa</i> , |
| <i>Athyris spiriferoides</i> , | <i>Diaphorostoma lineata</i> , |
| <i>Craniella hamiltoniæ</i> , | <i>Phacops rana</i> , |
| <i>Strophodontia inæquistriata</i> . | <i>Dalmanites boothi</i> . |

All of these species are common in any Hamilton section and range from top to bottom. A comparison of almost any three large faunules would show a good part of this list in common, so that it is hardly safe to correlate the zones on such evidence. The abundance of *Cystodicta* in all these may be explained by local conditions which favored the development of large numbers of colonies.

The twelve species which are most common at Canandaigua Lake in this faunule are as follows, their relative abundance being in the order named :

| | |
|--------------------------------------|---------------------------------------|
| <i>Chonetes scitulus</i> , | <i>Chonetes mucronatus</i> , |
| <i>Pholidops hamiltoniæ</i> , | <i>Chonetes coronatus</i> , |
| <i>Tropidoleptus carinatus</i> , | <i>Orthotetes chemungensis arcti-</i> |
| <i>Spirifer mucronatus</i> , | <i>striatus</i> , |
| <i>Strophodontia inæquistriata</i> , | <i>Phacops rana</i> , |
| <i>Cystodicta incisurata</i> . | <i>Tentaculites bellulus</i> . |
| <i>Tæniopora exigua</i> | |

For a comparison with this list, the dominant range frequency lists prepared by Williams¹ from a study of the Eighteen Mile Creek and Cayuga Lake sections and the distributional frequency list for eastern New York may be taken, for although these lists do not represent exactly the most common fossils, they are a close approximation.

For a further comparison there has been prepared, following William's method, a dominant range frequency list from the Thedford section as reported by Shimer and Grabau,² and it stands as follows :

¹ H. S. Williams, Bull. U. S. Geol. Survey, 210, 1903.

² "The Thedford Section," Bull. Geol. Soc. Am., vol. 13, pp. 149-186, 1902.

THEDFORD REGION. (DOMINANT RANGE FREQUENCY LIST.)

| Species. | No. of Zones in Which Found. |
|--------------------------------------|---------------------------------|
| 1. <i>Spirifer mucronatus</i> , | 5 |
| 2. <i>Primitopsis punctilifera</i> , | 5 |
| 3. <i>Stropheodonta iowaensis</i> , | 5 |
| 4. <i>Leiorhynchus laura</i> , | 4 |
| 5. <i>Chonetes lepida</i> , | 3 |
| 6. <i>Stropheodonta demissa</i> , | 3 |
| 7. <i>Cytrina hamiltonensis</i> , | 3 |
| 8. <i>Stropheodonta perplana</i> , | 3 |
| 9. <i>S. concava</i> , | 3 |
| 10. <i>Athyris fultonensis</i> , | 2 |
| 11. <i>Ceratopora intermedia</i> , | 2 |
| 12. <i>Favosites turbinata</i> . | 2 |

Shimer and Grabau divide the section into six zones, and there is no species reported which occurs in all. Three species occur in five of the six, one in four, five in three, and there are three which occur in only two. Of the twelve, nine are brachiopods, two corals and one an ostracod, which illustrates well the difference between the faunas of the western and eastern sections. In the distributional frequency list for eastern New York there are six brachiopods, five pelecypods, one trilobite and no corals. As the list for eastern New York is a distributional and not a range list, the writer has endeavored to construct a list from Prosser's report, in the absence of a detailed section, but the result is very unsatisfactory. The attempt, however, brings out one point.

In Prosser's report, some of his sections are sufficiently long and well enough located so that the approximate distance of the various zones below the top of the formation is known. There are thirteen such zones at different localities, which are located between 1 and 150 feet below the top of the Hamilton; ten located 150 and 300 feet below the top; five located between 300 and 600 feet below the top; and two which are between 600 feet below the top of the Hamilton and the top of the Marcellus.

Then making a composite section with four zones, there can be constructed a sort of a range frequency list, which is, however, of little value, because the number of species reported below the 600 foot level is very small. This list is as follows:

DOMINANT RANGE FREQUENCY LIST FOR EASTERN NEW YORK. COMPOSITE.

| Species. | No. of Zones in Which Found |
|--|--------------------------------|
| 1. <i>Spirifer mucronatus</i> . | 4 |
| 2. <i>S. granulosus</i> . | 4 |
| 3. <i>Tropidoleptus carinatus</i> . | 3 |
| 4. <i>Cypriardella tenuistriatus</i> . | 3 |
| 5. <i>Spirifer tullius</i> . | 2 |
| 6. <i>Athyris spiriferoides</i> . | 2 |
| 7. <i>Paleoneilo constricta</i> . | 2 |
| 8. <i>Nuculites triqueter</i> . | 2 |

The remarkable fact about this list is that only eight out of the 131 species reported from this region occur in more than one of these zones. That is, there are only eight species so far reported to have a range of over 450 feet, and only two that range through the whole thickness of the Hamilton in this region.

There are two species which occur in three of the zones, four that occur in only two, and the rest in only one.

Comparing the list with the distributional list as prepared by Williams it is found that the first three species on both lists are the same, though *Spirifer granulosus* and *Tropidoleptus carinatus* have changed places. *Cypriardella tenuistriatus* and *Spirifer tullius* are not in the distributional list and *Paleoneilo constricta* has changed from fifth to seventh place, while *Athyris spiriferoides* has risen from eleventh to sixth place. *Nuculites triqueter* has eighth place on both lists.

Now, comparing these lists, the various range frequency lists, with each other and with the list of the most abundant species at Canandaigua Lake, it is seen that they have only one species in common, namely, *Spirifer mucronatus*. The species most abundant in our faunule, *Chonetes scitulus* is number 6 on the Eighteen Mile Creek list, but does not occur in the others. Six of the species most common at Canandaigua Lake are not on any of the lists. *Phacops rana* is No. 2 on the Eighteen Mile Creek list and No. 5 of the Cayuga Lake list. *Chonetes mucronatus* is No. 8 on the Cayuga Lake list and *Orthothetes arctistriatus*, No. 9 on the Eighteen Mile Creek list.

Comparing the list of the most common species in this faunule with the standard fauna of dominant species as prepared by Williams for the New York-Ontario province it is found that four of our species are on that list, occupying first, second, third and eighth places re-

spectively. All the species on that list except the last, *Nucula bellistriata* occur in the faunule, thus showing that it is an aggregation of very typical Hamilton species.

ANNOTATED FAUNAL LIST.

Anthozoa-Actinozoa.

Heliophyllum halli E. & H.

Ill. Dev. Foss., pl. XXIII, 1876.

In the present collection there is only a single specimen of this coral, and that is of small size. The species is common in the upper Hamilton at Thedford and Eighteen Mile Creek, is fairly common at the same horizon at Livonia, but is found only near the base of the Cayuga Lake section, and is not reported from the eastern counties.

Michelinea stylopora Eaton.

Ill. Dev. Foss., 1876, pl. XVIII.

The specimens of this species are fairly common at Canandaigua Lake. It is abundant in certain beds in the lower Hamilton at Eighteen Mile Creek and Cayuga Lake and in some upper beds at Livonia. It has not been reported from Thedford or the eastern N. Y. localities.

Aulopora serpens Goldfuss.

Geol. Survey Mich., 1873-76, p. 81, pl. 33.

This occurs quite commonly on brachiopods in our faunule, usually on some species of *Stropheodonta*. It is rare at Thedford, Eighteen Mile Creek and Cayuga Lake.

Ceratopora dichotoma Grabau.

Proc. Bos. Soc. Nat. Hist., Vol. XXVIII, p. 418, pls. 2-4.

This species is common in our material and at Eighteen Mile Creek, but is rare at Thedford and Cayuga Lake. It is not reported from Livonia or the eastern localities.

Ceratopora jacksoni Grabau.

Proc. Bos. Soc. Nat. Hist., Vol. XXVIII, p. 415, pls. 1 and 2.

This species is about as common as the preceding one in our material. It is also common in the *Demissa* bed at Eighteen Mile Creek, but has not yet been reported from the other sections.

Vermes.

Spirorbis angulatus Hall.

15th Report N. Y. State Mus. Nat. Hist., p. 84.

This species is very rare in the present collection. It is common in the *Demissa* bed at Eighteen Mile Creek, but is not reported in the other sections under consideration.

Spirorbis spinuliferus Nich.

Pal. Prov. Ont., p. 83, 1875.

This species, which has not been reported from the other sections, is extremely abundant at Canandaigua Lake in this faunule, and seems to take the place of *S. angulatus*.

Cornulites hamiltoniae Grabau.

Bull. Buffalo Soc. Nat. Sci., Vol. VI, 1898-99, p. 150, fig. 32.

This species, which is found in the Pleurodictyon beds at Eighteen Mile Creek, is fairly common at our locality.

Cornulites sp.

With the above is another species, probably undescribed, which reaches a large size, has fewer and more irregular annulations.

Antodetus lindstræmi Clarke.

Am. Geol., Vol. XIII, p. 334, figs. 1-3, 1894.

This peculiar organism is quite common. The apical scar shows that it attached itself to various supports. The only specimen which remains in its attached position is resting upon a frond of *Tæniopora exigua*. Some species show a broad flat surface for attachment, as much as one half the width of the body whorl, while in others it is small, and often concave. This species also occurs rarely in the lower beds at Eighteen Mile Creek.

Antodetes sp.

With the above occurs another form of the same genus, which is sufficiently unlike *A. lindstræmi* to be called by another specific name. It is rare.

Bryozoa.

Ascodictyum stellatum N. & E.

Am. Mag. Nat. Hist., Ser. 4, XIX, p. 464, pl. XIX, figs. 1-6.

This little bryozoan is very common in the material, usually occurring attached to brachiopods or bryozoans.

Pinacotrypa plana Hall.

Pal. N. Y., Vol. VI, p. 215, pl. VIII, pp. 19, 20.

This species is quite common at Canandaigua Lake. It is found rarely in the lower Hamilton at Eighteen Mile Creek, but has not been reported from the other sections.

Monotrypa fructiosa Hall.

Ill. Dev. Foss., pl. XXXVIII, figs. 1-5, 1876.

The bryozoan known by this name, which is given no standing by Nickles and Bassler, is very abundant in the present material. It occurs also at Eighteen Mile Creek.

Monotrypa ? sp.

With the above is another more slender species which seems to be congeneric with it. It is also common.

Fenestella emaciata Hall.

36 Ann. Rept. N. Y. State Mus. Nat. Hist., p. 68, 41 Rept. idem, pl. VIII.

This species, which is quite common in the *Demissa* bed at Eighteen Mile Creek, is common also in our material.

Reteporina striata Hall.

36 Ann. Rept. N. Y. State Mus. Nat. Hist., p. 72.

This is another species which occurs both in the *Demissa* bed at Eighteen Mile Creek and in our faunule. It is rare in both.

Isotrypa sp.

A few well preserved fronds which appear to belong to this genus occur with the other Fenestellidæ.

Hemitrypa cribosa Hall.

Trans. Albany Institute, p. 177.

Specimens which appear to belong to this species occur occasionally in the material.

Polypora fistulata Hall.

36 Ann. Rept. N. Y. State Mus., p. 59.

There are a few specimens which seem to agree with the figures and descriptions of this species. It does not occur in any of the sections we are comparing our faunule with, but has been reported from Genesee and Erie Counties, N. Y. and West Williams, Ontario.

Polypora multiplex Hall.

Rept. N. Y. State Geol., 1886, p. 66.

This species is common in the upper part of the Hamilton at Livonia, and in our faunule, and occurs rarely at Cayuga Lake above the Encrinal.

Rhombopora tortalineae Hall.

Pal. N. Y., Vol. VI, p. 180, pl. LVI.

This species occurs rarely in our material.

Streblotrypa hamiltonensis Nich.

Pal. N. Y., Vol. VI, p. 191, pl. LV.

This is a common fossil at Thedford above the Encrinal. It occurs rarely in the lower part of the Eighteen Mile Creek section and is very rare at our locality. It has not been reported further east.

Ptilodictya plumea Hall.

Pal. N. Y., Vol. VI, p. 271, pl. LXI.

Several very complete colonies of this species were found in the collection. It occurs also in the *Demissa* bed at Eighteen Mile Creek.

Cystodicta incisurata Hall.

Pal. N. Y., Vol. VI, p. 241, pl. LX.

This is one of the most common species in our faunule. It is also very common in the *Stictopora* beds at Eighteen Mile Creek and Cayuga Lake and in the upper Hamilton at Livonia.

It occurs in the eastern counties only at East Berne.

Tenipora exigua Nich.

Geol. Mag. Lon., N. S., Vol. I, p. 120.

This is also a common fossil at Canandaigua Lake and is quite common in all sections from Eighteen Mile Creek to Albany Co.

Acrogenia prolifera Hall.

Pal. N. Y., Vol. VI, p. 267, pl. LXIII.

This peculiar bryozoan is fairly common in our faunule. It is not reported from the other sections.

Lichenalia stellata Hall.

Pal. N. Y., Vol. VI, p. 195, pl. LVIII.

This species is rare in the *Demissa* bed at Eighteen Mile Creek and common in the Hamilton above the Encrinal limestone at Divonia and Canandaigua Lake.

Paleschara reticulata Hall.

Third Ann. Rept. N. Y. State Geol., p. 6.

This species occurs rarely in both the *Demissa* bed at Eighteen Mile Creek and in the faunule at Canandaigua Lake.

Brachiopoda.*Lingula* sp.

A few fragments of Lingulas which could not be identified on account of their condition, were found in breaking up pieces of the rock. The *Lingula* shells were not silicified.

Camarotoechia congregata Conrad.

Pal. N. Y., Vol. IV, 1867, p. 341, pl. 54.

This species is very rare, and only one or two specimens were found. The species seems to reach its greatest development toward the east as it has not been reported from Thedford, Eighteen Mile Creek or Livonia, and is rare in the Cayuga Lake section. It is abundant at certain localities in Otsego and Albany counties.

Camarotoechia horsfordi Hall.

Pal. N. Y., Vol. IV, 1867, p. 339, pl. 54.

In the present material this species is very rare. It occurs rarely throughout the section of Eighteen Mile Creek, and was found in the Encrinal bed and in the *Cystodicta* zone at Cayuga Lake. It has not been reported from the eastern New York counties.

Camarotoechia sappho Hall.

Pal. N. Y., Vol. IV, 1867, p. 34, pl. 54.

This is another species which occurs only in the *Cystodicta* bed and in the Encrinal at Cayuga Lake. It has been found in all sections from Thedford to the eastern counties, is common below the Encrinal limestone at Eighteen Mile Creek and abundant in the Upper Hamilton at West Berne, Albany Co. In the faunule from Canandaigua Lake it is very rare.

Trigleria lepida Hall.

Pal. N. Y., VIII, 1893, p. 274, pl. 50, figs. 36-40.

This uncommon fossil, of which fifteen specimens were obtained from this material, is here much smaller than the typical specimens. The largest is 6.8 mm. long and 6 mm. wide, and has 14 striæ on the brachial and 15 on the pedicle valve. The largest specimen figured by Hall is 11 mm. long and 9.5 mm. wide. According to that author an adult should have from 20 to 25 plications.

Of the sections under consideration, Thedford is the only one which has yielded specimens of this shell.

Eunella linkleri Hall.

Pal. N. Y., Vol. IV, 1867, p. 397, pl. 60, figs. 49-65.

This is another species with an eastern distribution. It is common from Canandaigua Lake to Albany Co., but has not been reported from Thedford, Eighteen Mile Creek or Livonia. The specimens from the present material do not show any unusual characters.

Tropidoleptus carinatus (Conrad).

Pal. N. Y., Vol. IV, 1867, p. 407, pl. 62, figs. 2, 3.

This species is very abundant in the faunule, but the individuals do not attain so great a size here as in some other localities. The largest specimen is 22×28 mm., while the average is somewhat below that size, about 19×24 mm., with from 17 to 21 plications. There are two varieties, one in which the plications are rounded, and another in which they are more angular, and separated by wide interspaces.

As is well known, this species is very abundant in the eastern part of New York State, is common all through the section at Cayuga Lake, common above the Encrinal at Livonia and Eighteen Mile Creek, and very rare at Thedford, Ont.

Atrypa reticularis Linnæus.

Pal. N. Y., Vol. IV, 1867, p. 316, pls. 51-53 A.

This fossil is very rare at the Canandaigua Lake locality. It is found in all the sections from Thedford to Albany Co.

Cyrtina hamiltonensis Hall.

Pal. N. Y., Vol. IV, 1867, p. 268, pl. 27, figs. 1-4, pl. 44, figs. 26-33, 38-52.

This is a species which seems to reach a higher development in the western than in the eastern sections. It is rare in eastern New York, and at Cayuga Lake, common at Canandaigua Lake, fairly common near the top of the Livonia section, common below the Encrinal at Eighteen Mile Creek and common above the limestone at Thedford.

The largest shell in the present collection is 9 mm. long and 13 mm. wide, with 16 plications. It is a little above the average size for the adults from this locality. The majority of the specimens agree well in size and other particulars with specimens from the other Western New York localities. The specimens from Thedford, Ont., the Alpena, Mich., are somewhat larger.

Spirifer mucronatus Conrad.

Pal. N. Y., Vol. IV., 1867, p. 216, pl. 34, figs. 1-32.

This species is common in this faunule, as in all the sections from Thedford to eastern New York. All the adult individuals in the collection belong to one variety. The valves are about equally convex, and the cardinal extremities acute, but not mucronate. The width is from two to three times the length. There are usually from 10 to 26 pairs of plications, depending on the size of the individual, and the

fold of the dorsal valve is always divided by a median depressed line. The largest specimen is 14.8×52 mm. This type is found also in eastern New York, East Bethany, Eighteen Mile Creek and Thedford, Ont., but in all those localities there are other varieties associated with it.

S. audaculus Conrad.

Pal. N. Y., Vol. IV., 1867, p. 227, pl. 38.

The specimens of *S. audaculus* are few, and smaller than the usual adult size of this shell. The species is rare at Thedford, but common in the other sections. It usually is most common in the upper zones east of Eighteen Mile Creek.

S. granulosus Conrad.

Pal. N. Y., Vol. IV., 1867, p. 223, pl. 36.

In the lower zones at Eighteen Mile Creek and in certain localities in the upper Hamilton of Otsego Co., this species is very common. At Livonia and Canandaigua Lake it is rare, and it is likewise uncommon in Albany and Schoharie Counties.

Delthyris consobrinus d'Orbigny.

Pal. N. Y., Vol. IV., 1867, p. 222, pl. 35.

This species showed the usual characters, but some specimens had so few plications as to approach *D. sculptis* in character. The species has not been reported either from Thedford or eastern New York. It is common in this faunule, as it is in two of the zones above the Encrinal at Eighteen Mile Creek. It was not reported from Livonia and is not common at Cayuga Lake except in a couple of zones near the top of the section.

Delthyris sculptis Hall.

Pal. N. Y., Vol. IV., 1867, p. 221, pl. 35.

Two or three well preserved specimens of this species were obtained which showed the usual strong plications. The vertical range of this species does not seem to be very great. At Thedford and Eighteen Mile Creek it is confined to the Encrinal limestone, and at Cayuga Lake it occurs in only one zone (D). At Livonia it occurs above the Encrinal, as it does at Canandaigua Lake.

Reticularia fimbriata Conrad.

Pal. N. Y., Vol. IV., 1867, p. 214, pl. 33.

This species has been found from Thedford to Otsego Co., but it is usually rare in the various localities, as it is in this faunule.

Ambocoelia umbonata Conrad.

Pal. N. Y., Vol. IV, 1867, p. 259, pl. 44.

While young individuals of this species were not uncommon, only three or four adults were found, and they were all of small size. The species is common from Thedford to Albany Co.

Nucleospira concinna Hall.

Pal. N. Y., Vol. IV, p. 867, p. 279, pl. 45.

This species is rare in this faunule, rare in the upper Hamilton at Thedford and Livonia, and found all through the sections at Eighteen Mile Creek and Cayuga Lake, though it occurred in only a few zones and was rare except for a short distance below the Encrinal at Eighteen Mile Creek. It is not reported from eastern New York.

Athyris spiriferoides Eaton.

Pal. N. Y., Vol. IV, 1867, p. 285, pl. 46.

This shell common and of large size, although few of the specimens were silicified. The species is common in all sections.

Pholidops oblata Hall.

Pal. N. Y., Vol. IV, 1867, p. 414, pl. 3, fig. 10.

Of the sections here used for the comparisons, only two, Eighteen Mile Creek and Cayuga Lake, have furnished specimens of this fossil, and in both localities it is confined to the Encrinal limestone, where it is found but rarely. In the present locality it is common, over 200 specimens having been obtained.

P. hamiltoniæ Hall.

Pal. N. Y., Vol. IV, 1867, p. 32, pl. 3, figs. 6-7.

This is one of the most abundant fossils in the faunule, as there are about 1,500 specimens in the collection. According to Cleland, the vertical range of this species is about the same in the Eighteen Mile Creek, Livonia and Cayuga Lake sections, and the center of abundance in the upper part of the Lower Hamilton. The largest specimen in this collection is 3.9 mm. long and 3.2 mm. wide, practically the dimensions of the largest specimen from Cayuga Lake. The shell has been found in the Upper Hamilton at Thedford, but has not yet been reported from the eastern counties.

Crania crenistriata Hall.

Pal. N. Y., Vol. IV, 1867, pl. 3, figs. 1-16.

This species is not common. The largest specimen is 12.5 mm. long and 13.5 mm. wide. The fossil is found rarely in the upper

Hamilton at Thedford, and below the Encrinal at Eighteen Mile Creek.

Craniella hamiltoniæ Hall.

Pal. N. Y., Vol. IV, 1867, p. 27, pl. 3, figs. 17-23.

This species is fairly common in the material and presents the usual characters. The largest specimen is 15.2×19 mm. The dorsal valves show a variety of markings, varying with the shell to which they were attached. Most of them show the coarse ribbing of *Tropidoleptus* or *Spirifer*. The species does not seem to be common very often, but is found from Thedford to Otsego Co.

Stropheodonta concava Hall.

Pal. N. Y., Vol. IV, 1867, p. 96, pl. 16, figs. 1a-1h.

This species is very rare in the locality. One dorsal valve of an adult individual was found, and two or three shells of younger specimens. The species is found in all sections from Thedford to Otsego Co., but is seldom common.

S. demissa Conrad.

Pal. N. Y., Vol. IV., 1867, p. 101, pl. 17.

This species is found from Thedford to Cayuga Lake, but its vertical range in the various sections is very limited and it cannot be called a common fossil except on its western range where it is common in certain zones. At Thedford it is very rare below the Encrinal, but common in two of the zones above it. At Eighteen Mile Creek it occurs in shale a foot below the Encrinal and in the limestone itself. At Livonia it is restricted to the Encrinal and at Cayuga Lake to a single zone about 50 feet below the Encrinal. It is a very rare fossil at Canandaigua Lake.

S. inæquistriata Conrad.

Pal. N. Y., Vol. IV., 1867, p. 93, pl. 12, figs. 6-8.

In all sections from Eighteen Mile Creek to Otsego Co., this fossil is common, and in the present faunule is represented by about 600 specimens which show no unusual characters.

S. junia Hall.

Pal. N. Y., Vol. IV., 1867, p. 108, pl. 18, figs. 3, 4.

Only one specimen which could be referred to this species was found. It has been reported from the Lower Hamilton at Eighteen Mile Creek and from the very top at Livonia and Cayuga Lake.

S. perplana Conrad.

Pal. N. Y., Vol. IV., 1867, pp. 92, 98, pl. 11, fig. 22, pl. 12, figs. 13-15.

While not so abundant as *S. inæquistriata*, this is a common species at the Canandaigua Lake locality. The specimens are all smaller than the average, the largest being 21×24 mm. The species occurs from Thedford to Otsego Co., but is rare at both limits and most common at the meridian of Cayuga Lake.

Pholidostrophia iowænsis Owen.

Pal. N. Y., Vol. IV., 1867, p. 104, pl. 18, fig. 1.

In certain zones of all the sections from Thedford to Cayuga Lake, this species is common, as it is in the present faunule. Our specimens are of about the usual size.

Orthothetes chemungensis Conrad. var. *pectenacea* Hall.

Pal. N. Y., Vol. IV., 1867, p. 64, pl. 10, fig. 6.

This variety, which Schuchert has considered as a synonym for the true species *chemungensis* Conrad, is quite common in the present collection, but the specimens are rather small as compared with Hall's figures. This type was found by Cleland in zone A of the Cayuga Lake section.

O. chemungensis var. *arctistriatus* Hall.

Pal. N. Y., Vol. IV., 1867, p. 71, pl. 9.

This variety is also common in the material, and most of the specimens are rather small. The largest is 16 mm. long and 22 mm. in width. This variety occurs in both the upper and lower Hamilton in the Thedford, Eighteen Mile Creek and Cayuga Lake sections, but only above the Encrinal at Livonia.

O. bellulus Clarke.

13 Ann. Rept. N. Y., State Geol. 1895, pp. 176, 187, pl. 4, figs. 2-4.

This species was described from the Marcellus of the Livonia section and has been reported from the Marcellus at Stony Point on Lake Erie, where it occurs only a few inches above the Onondaga. It has not been found in the Hamilton previous to the present instance. The largest specimens in this collection are about 10×14.5 mm. and have 24 to 30 striæ.

Chonetes coronatus Conrad.

Pal. N. Y., Vol. IV., 1867, p. 133, pl. 21, figs. 9-12.

This species occurs in all the sections from Eighteen Mile Creek to Albany Co. It is abundant in the present material, but does not attain the size which the same species reaches in some other localities. The largest specimen is 15.4 mm. long and 23 mm. wide and the adults have from 80 to 100 striæ.

Chonetes mucronatus Hall.

Pal. N. Y., Vol. IV., 1867, p. 124, pl. 20, fig. 1, pl. 21, fig. 1.

This species is common in the sections from Eighteen Mile Creek to Albany Co. At Canandaigua Lake it is abundant. The largest specimen is 11 mm. long and 13 mm. wide and the adults have from 25 to 40 striæ.

Chonetes scitulus Hall.

Pal. N. Y., Vol. IV., 1867, p. 130, pl. 21, fig. 4.

This is the most abundant species in the present collection and there are at least 3,500 specimens. The adults are of the ordinary size, the largest 6×9 mm. there are usually 30 to 40 striæ on the anterior margin. This is a common fossil in all zones of the sections from Eighteen Mile Creek to Cayuga Lake, but is rare in the eastern counties.

Chonetes robustus Raymond.

Am. Jour. Sci., Vol. XVII., p. 289, pl. XVII, rows 1, 2. April, 1904.

This species is not uncommon in the material. It occurs also in East Bethany, N. Y.

Strophalosia truncata Hall.

Pal. N. Y., Vol. IV., 1867, p. 160, pl. 23, figs. 12-24.

Though it has not been found in the Thedford or Eastern New York sections, this species is common in certain zones of the sections from Eighteen Mile Creek to Cayuga Lake. At Eighteen Mile Creek and Cayuga Lake it occurs below the Encrinal, and at Livonia above it. It is common in the present faunule and of fair size.

Productella spinulicosta Hall.

Pal. N. Y., Vol. IV., 1867, p. 160, pl. 23.

This species is rare, and usually poorly preserved in this locality. It occurs in all three divisions (upper, Encrinal, and lower Hamilton), at Eighteen Mile Creek, Livonia, and Cayuga Lake.

Rhipidomella penelope Hall.

Pal. N. Y., Vol. IV, 1867, p. 50, pl. 6.

This species is very rare at Canandaigua Lake as it is in most of the sections except for the top of the Hamilton at Thedford and Eighteen Mile Creek. It has not been reported from Eastern New York.

R. vanuxemi Hall.

Pal. N. Y., Vol. IV, 1867, pp. 40, 47, pl. 5, fig. 6, pl. 6, fig. 3.

The specimens of this species, though common, were all small. The largest is only 15 mm. long. The species occurs from Thedford to Albany Co., N. Y.

Pelcycypoda.

Nuculites oblongatus Conrad.

Pal. N. Y., Vol. V, pl. 1, p. 324, pl. 47.

The largest individual of this species in the collection is 12 mm. high and 24 mm. long. The species is very rare here, and at Eighteen Mile Creek, where it occurs in only one zone. It is quite common all through the section at Cayuga Lake and occurs in most of the sections in the eastern counties.

Nuculitus triqueter Conrad.

Pal. N. Y., Vol. V, pt. 1, p. 326, pls. 47, 93.

This species occurs only as casts in the present material and is not common. The largest specimen is 7 mm. high and 9 mm. long.

The distribution is about the same as for *N. oblongatus*.

Nucula corbuliformis Hall.

Pal. N. Y., Vol. V, pt. 1, p. 319, pl. 46.

Like the above, the individuals of this species are always small and occur only as casts. The largest specimen is 5 × 8 mm. This species has not been reported from the sections west of Canandaigua Lake, but is common all through the Cayuga Lake section, and rare in the eastern counties.

Paleoneilo constricta Conrad.

Pal. N. Y., Vol. V, pt. 1, p. 333, pls. 48, 51.

This species which is common all through the Cayuga Lake section is rare at Eighteen Mile Creek, Livonia, Canandaigua Lake, and the eastern localities. Our specimens are rather small, the largest being 9.5 × 15 mm.

Conocardium eboraceus Hall.

Pal. N. Y., Vol. V, p. 412.

This species is very rare in our faunule, and is represented by fragments of the shell.

Actinoptera decussata Hall.

Pal. N. Y., Vol. V, pl. 1, p. 111, pls. 17, 18, 20, 84.

This species is very rare, and only one good specimen was obtained. That is 12 mm. high and 19 mm. long. It shows the usual surface markings, the concentric ridges being high and sharp. The species is reported as rare in the Encrinal and above it at Eighteen Mile Creek and Cayuga Lake, and common in both at Livonia.

Aviculopecten exacutus Hall.

Pal. N. Y., Vol. V, pt. 1, p. 8, pl. 111.

All our specimens of this shell are small and fragmentary. The largest is 17 mm. high. The species is fairly common in the lower part of the Hamilton at Eighteen Mile Creek and in the upper part at Livonia. It is not reported further east.

Aviculopecten princeps Conrad.

Pal. N. Y., Vol. V, pt. 1, p. 1, pls. 1, 5, 6, 24, 81.

This species is more common than any of the other lamellibranchs in the present faunule and reaches more nearly its normal size. The largest specimen is 57 mm. high and about 70 mm. long. The species is fairly common in all the sections except the extreme eastern and western ones. It is very rare at Thedford and does not occur in the eastern counties except at a few localities.

Aviculopecten scabridus Hall.

Pal. N. Y. Vol. V. pt. 1, p. 7, pl. 3.

The individuals of this species obtain a fair size at this locality. The largest is 28 mm. high. The species is common in the upper Hamilton at Livonia and is rare at Canandaigua Lake and in the lower Hamilton at Cayuga Lake. It is not reported from the other sections.

Pterineopecten intermedius Hall.

Pal. N. Y., Vol. V, pt. 1, p. 68, pls. 17, 83.

The one well preserved specimen in the collection shows the usual characters, though it is of small size, 14 mm. high.

The species is rare at Cayuga Lake, which is the only one of the sections from which it is reported.

Pterineopecten hermes Hall.

Pal. N. Y., Vol. V, pt. 1, p. 64, pl. 17.

The largest specimen of this species in the collection is 16 mm. high. It is rare here, as also at Eighteen Mile Creek and Cayuga Lake. It is not reported elsewhere.

Pterincopecten regularis Hall.

Pal. N. Y., Vol. V, pt. 1, p. 70.

There are only a few fragments representing this species, but they show the usual surface markings.

Pterincopecten conspectus Hall.

Pal. N. Y., Vol. V, pt. 1, p. 66, pl. 17.

The specimens representing this species are very small. The largest is 8×10 mm. and the others are much smaller. The species is rare at Eighteen Mile Creek and Cayuga Lake as well as at the present locality. It is not reported from the other localities.

Lyriopecten orbiculatus Hall.

Pal. N. Y., Vol. V, pt. 1, p. 42, pls. 4, 82.

A valve resembling the figures of this species was found. The species is fairly common in the upper Hamilton at Livonia.

Modiomorpha alata Conrad.

Pal. N. Y., Vol. V, pt. 1, p. 278, pls. 37, 80.

This species is very rare here as in the other sections where it is reported, namely; the Eighteen Mile Creek and Cayuga Lake sections.

Cypricardella bellistriata Conrad.

Pal. N. Y., Vol. V, pt. 1, p. 485, pls. 79, 96.

The casts of this species are fairly common, though the shells are rarely preserved. The species attains its usual size.

It is found in all the sections from Eighteen Mile Creek to Albany county but is most common at Cayuga Lake.

Cypricardinia indenta Conrad.

Pal. N. Y., Vol. V, pt. 1, p. 485, pls. 79, 96.

This species is represented by some fragments which show the usual surface, but indicate individuals of small size. They are rare. The species is common at Eighteen Mile Creek and Cayuga Lake and rare at Livonia and in Otsego county.

Nyassa arguta Hall.

Pal. N. Y., Vol. V, pt. 1, p. 53, figs. 9-20.

Two casts appear to belong to this species. If so this is the farthest west this fossil has been found. It is common in Otsego and Albany counties.

Gastropoda.*Pleurotomaria capillaria*, Conrad.

Pal. N. Y., Vol. V, pt. 2, p. 77, pl. 20.

A few fragments of this species, showing the usual surface marking, were found. The species has been reported from Thedford, is fairly common at the base of the Hamilton and Eighteen Mile Creek, and occurs in all the sections under examination.

Cyclonema hamiltoniæ Hall.

Pal. N. Y., Vol. V, pt. 2, p. 37.

A single specimen is referred doubtfully to this species.

Bellerophon leda Hall.

Pal. N. Y., Vol. V, pt. 2, p. 110, pl. 23.

Specimens of this shell are quite numerous and the largest is of about the usual size for the species. It is found in the sections from Eighteen Mile Creek to Cayuga Lake.

Platyceras bucculentum Hall.

Pal. N. Y., Vol. V, pt. 2, p. 10, pl. 3.

There are numerous small specimens in the collection which agree with Hall's figures of this species, except that they do not have the strong folds at the aperture. The species is found from Thedford to Otsego county.

Platyceras carinatus Hall.

Pal. N. Y., Vol. V, pt. 2, p. 5, pl. 2.

Most of the specimens are small, but show the characteristic features. The species is found from Eighteen Mile Creek to Albany county.

Platyceras symmetricum Hall.

Pal. N. Y., Vol. V, pt. 2, p. 9.

Specimens of this species are common, but very few show the complete aperture. The species is rare in the lower Hamilton at Eighteen Mile Creek and fairly common in the upper part of the Livonia section.

Diaphorostoma lineata Conrad.

Pal. N. Y., Vol. V, pt. 2, p. 21, pl. 10.

All the specimens are quite small, the largest being only 12 mm. in greatest diameter and showing three whorls. The species is common here as it is at Eighteen Mile Creek, Livonia, and Cayuga Lake. At Thedford it is rare, although it occurs all through the section.

Loxonema hamiltoniæ Hall.

Pal. N. Y., Vol. V, pt. 2, p. 45, pl. 13.

Specimens of this species are of about the usual size and appearance. The species is abundant above the Encrinal at Livonia and occurs all through the section at Cayuga Lake.

Styliola, sp.

A few specimens of some species of this genus were observed in the blocks before etching.

Tentaculites bellulus Hall.

Pal. N. Y., Vol. V, pt. 2, p. 169, pls. 31, 31A.

Individuals of this species are very numerous and show some variation in the annulations. The species is fairly common at Livonia and very rare at Cayuga Lake.

Hyolithes acilis Hall.

Pal. N. Y., Vol. V, p. 2, p. 197, pls. 32, 32A.

Three small specimens represent the apical end of this species. It is found rarely throughout the Cayuga Lake section.

Platyceras thetys Hall.

Pal. N. Y., Vol. V, pt. 2, p. 8.

There are a few small, not very perfectly preserved specimens belonging to this species. It occurs at Livonia and in Albany county.

Cephalopoda.*Orthoceras*.

The siphuncle of some small species of *Orthoceras* was obtained.

Crustacea.*Primitopsis punctilifera* Hall.

13 Ann. Rept. N. Y. State Mus. Nat. Hist., p. 92.

A few specimens are referred to this species. It is common at Thedford and rare throughout the section at Eighteen Mile Creek.

Kirkbya parallela Ulrich.

Jour. Cinn. Soc. Nat. Hist., Vol. XIII, p. 192, pl. 15, figs. 2a, b.

This species is fairly common.

Strepula sigmoidalis Jones.

Quar. Jour. Geol. Soc., Vol. XLVI, p. 11.

This is one of the most common of the ostracods in this collection.

Ischilina lineata Jones.

Quart. Jour. Geol. Soc., Vol. 46, p. 21, pl. 2, figs. 5a, b, 8a, b.

Only a few specimens found.

I. fabacea Jones.

Quart. Jour. Geol. Soc., Vol. XLVI, p. 22, pl. 2.

This species is also very rare.

Primitia seminulum Jones.

Ann. Mag. Nat. Hist., Ser. V, Vol. XVII, p. 413, pl. 14.

There are several specimens of this species.

Octonaria stigmata Ulrich.

Jour. Cinn. Soc. Nat. Hist., Vol. XIII, p. 193, pl. 16, figs. 8a, b.
Rather uncommon.

Ctenobolina papillosa Ulrich.

Jour. Cinn. Soc. Nat. Hist., Vol. XIII, p. 186, pl. 15, figs. 8a-c.
A few specimens are with some doubt referred to this species.

Beyrichia kolmodini Jones.

Jour. Cinn. Soc. Nat. Hist., Vol. XIII, p. 190, pl. XIV, figs. 1a-c.
This species is common.

Halliella retifera Ulrich.

Jour. Cinn. Soc. Nat. Hist., Vol. VII, p. 185, pl. 15, figs. 5a-c.
Another rare species.

Moorea bicornuta Ulrich.

Jour. Cinn. Soc. Nat. Hist., Vol. XIII, p. 191, pl. 16, figs. 4a-c.
Only a couple of specimens of this ostracod were found.

Ostracoda sps.

Several other species of ostracods were obtained, but have not yet been identified.

Proetus rowi Green.

Pal. N. Y., Vol. VII, p. 119, pls. 21, 23.

A few separated head and tail shields of this species were found. They were of small size. The species occurs rarely in the sections from Eighteen Mile Creek to Cayuga Lake, and a single specimen has been found at Worcester in Otsego county.

Cyphaspis ornatas Hall.

Illust. Dev. Foss., 1876, pl. 21.

A single fragment of a specimen of this species was found.

Dipleura dekayi Green.

Pal. N. Y., Vol. 7, p. 7, pls. 2-5.

Portions of several tail shields were obtained. The species occurs from Eighteen Mile Creek to Otsego Co.

Phacops rana Green.

Pall. N. Y., VII, p. 19, pls. 7, 8, 8A.

Specimens of this species are quite common, although usually of small size. The species is common in all sections except in the eastern counties where it is rare except locally.

Cypræus boothi Green.

Pal. N. Y., Vol. VII, p. 42, pls. 16, 16a.

Specimens of this species were common. The species is common from Thedford to Otsego county.

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EXPLANATION OF PLATES.¹

PLATE I.

Pholidops hamiltoniæ Hall.

Rows 1 and 2. Series of dorsal valves. $\times 2$.

Rows 3 and 4. Series of ventral valves. $\times 2$.

PLATE II.

Pholidops oblata Hall.

Rows 1 and 2. Series of dorsal valves. $\times 2$.

Rows 3 and 4. Series of ventral valves. $\times 2$.

PLATE III.

Row 1. Partial series of *Stropheodonta perplana* Conrad; ventral valves. Specimens Nos. 3-9 show well the mucronate cardinal extremities of the adolescent individuals.

Rows 2-4. Series of *Stropheodonta inaequistriata* Conrad; ventral valves, showing the shells in neanic, ephebic, and gerontic stages.

PLATE IV.

Chonetes scitulus Hall.

Rows 1 and 2. Series of ventral valves. $\times 2$.

Rows 3 and 4. Series of dorsal valves; interior view. $\times 2$.

Specimens Nos. 1 and 2 of Row 1, and Nos. 1 and 2 of Row 3, show the ventral sinus and dorsal fold of the very young stages. Most of the specimens in Row 4 show the brachial scars.

PLATE V.

Row 1. Partial series of *Orthothetes chemungensis* var. *pectenacea* Hall; dorsal valves. $\times 2$.

Row 2. Partial series of *Orthothetes chemungensis* var. *arctistriatus* Hall; dorsal valves. $\times 2$.

¹ Unless otherwise stated, the figures are natural size.

- Row 3. Partial series of *Orthothetes bellulus* Clarke; dorsal valves. $\times 2$.
 Rows 4 and 5. Series of *Chonetes mucronatus* Hall; ventral and dorsal valves.
 $\times 2$.
 Row 6. Series of *Cyrtina hamiltonensis* Hall; dorsal valves. $\times 2$.

PLATE VI.

- Rows 1 and 2. Partial series of *Spirifer mucronatus* Conrad; dorsal valves.
 Row 3. Series of *Chonetes coronatus* Conrad; ventral valves, exterior.
 Row 4. The same; dorsal valves, interior.

PLATE VII.

- Rows 1 and 2. Series of *Chonetes robustus* Raymond; ventral and dorsal valves.
 $\times 2$.
 Rows 3 and 4. Series of *Strophalosia truncata* Hall; dorsal and ventral valves.
 $\times 2$.

PLATE VIII.

Tropidoleptus carinatus Conrad.

- Rows 1 and 2. Series of ventral valves.
 Rows 3 and 4. Series of dorsal valves.

NOTE.—A bulletin of the New York State Museum (number 63), on "A Stratigraphic and Paleontologic Map of the Canandaigua Lake and Naples Quadrangles" has been issued since this article has been in the printer's hands. In it, the authors, Dr. John M. Clarke and D. Dana Luther, refer to the so-called encrinal limestone of the region as the Tichenor limestone and give the following section (in descending order).

9. Tully limestoneabout 3 feet.
 8. Moscow shale.....125 feet.

Intercalated in this, about fifty feet below the Tully and seventy-five feet above the Tichenor, is the Menteth limestone, a foot in thickness, in which the fossils are silicified.

7. Tichenor limestone.....1 foot.
 6. Canandaigua shale.....about 125 feet.
 5. Skeneateles shale.....125 feet.
 4. Cardiff shale.....about 50 feet.
 3. Stafford limestone.....1 foot (?)
 2. Marcellus shale.....about 50 feet.
 1. Onondaga limestone.

The writer furnished Dr. Clarke with a list of the fossils identified from the silicified material here discussed and it is printed, with some additions by Dr. Clarke in the above bulletin. The authors must, however, be in error in assigning the list to the Menteth limestone alone, for I was assured by the late Dr. Beecher, whose skill as a collector is universally recognized, that he had obtained the material from several different layers through a range of some seventy-five feet above the encrinal limestone, and during the process of etching I remember that he was particularly interested in observing the relative value of the various layers as producers of fine fossils.

The different blocks used differed greatly both in lithologic character and in fossil contents, and must have been derived from various layers.

III. ON TWO SPECIES OF TURTLES FROM THE JUDITH RIVER BEDS OF MONTANA.

BY O. P. HAY.

Professor J. B. Hatcher has placed in the hands of the writer three specimens of fossil turtles, which were collected during the year 1903 in the Judith River beds of Montana. These are found to belong to two species, which have not hitherto been described. They are as follows :

ASPIDERETES BEECHERI Hay.

Trionyx foveatus, Baur, G., Proc. Acad. Nat. Sci. Phila., 1891, p. 418 (not of Leidy).

The type of this species belongs to the collection of the Peabody Museum, Yale University. It was collected in the Laramie beds of Converse County, Wyoming, in the year 1889, by Prof. J. B. Hatcher and the late Dr. Charles E. Beecher. It is a nearly complete individual, lacking few parts, except the head and most of the neck. A description of it, accompanied by illustrations, will shortly appear in the American Journal of Science. Although the two specimens belonging to the Carnegie Museum are from the more ancient Judith River beds, the writer is unable to discover any characters to distinguish them from the Laramie specimen. Of these Judith River specimens one, number 445, has had a length of about 375 mm. The other, number 541, is smaller. Both were collected on Fish Creek, Montana.

BAENA CALLOSA sp. nov.

The type of this species bears the number 330 of the Carnegie Museum Catalogue. It was collected on Willow Creek, Montana. It consists of an imperfect carapace and the greater portion of the plastron.

Of the carapace there is present about the anterior three fourths ; but of this most of the peripherals and portions of the costals are missing. The sutures between the various bones appear not to have been obliterated, but the preservation is such that it is impossible to trace them satisfactorily. Most of the anterior border of the nuchal has been

broken away. It has had a thickness of about 6 mm. and in section the edge has been rounded. The third and the fifth and sixth costals have been much thickened to receive the buttresses of the plastron. The second costal, near its proximal end, has a thickness of 5 mm; the fourth, near its distal end, a thickness of 3 mm.

The surface of the carapace presents evidences of a low ridge along the midline. On the area of the first costal scute there is a low elongated boss. In front of this, on the first peripheral, there is

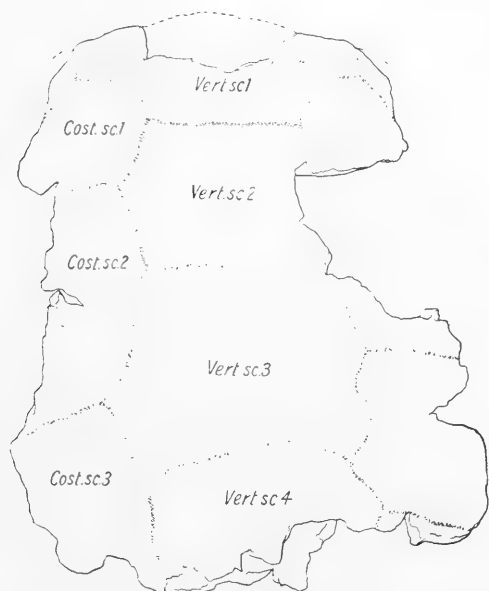


FIG. 1. *Bañna callosa* Hay. Diagram of portion of carapace, $\frac{3.3}{10.0}$ natural size, *vert.sc.*, vertebral scute; *cost.sc.*, costal scute.

another and smaller boss. Probably a complete carapace will show these to form the anterior ends of two lateral carinæ.

The carapacial scutes (Fig. 1) have been separated by very distinct sulci. The first vertebral scute has been small, having a length of probably less than 30 mm. and a width of 60 mm. The second vertebral is 48 mm. long and 75 mm. wide; the third vertebral 57 mm. long and 65 mm. wide. The fourth has been fully as wide as the third. The first costal scute is small, being about 36 mm. in antero-posterior extent.

The plastron (Plate IX) has the hinder extremity missing. The total length cannot, therefore, be accurately determined; but it must have been close to 205 mm. The breadth, measured on the mesoplastra and following the curves, is 186 mm. The whole width of the animal was, of course, somewhat greater. The median region is slightly concave to a ridge which runs from the free border of the front lobe

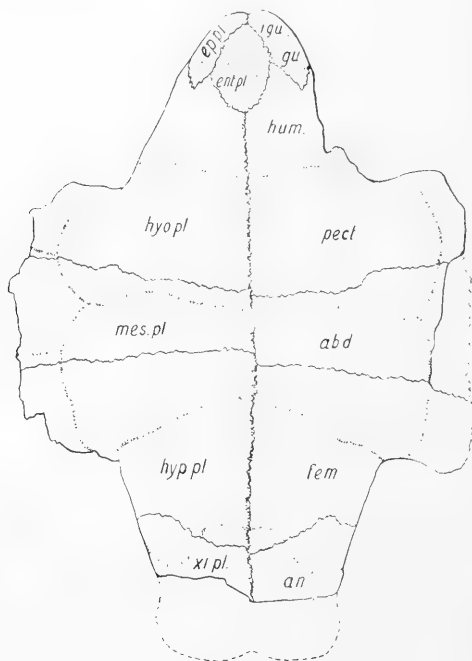


FIG. 2. *Baëna callosa* Hay. Diagram of plastron. $\frac{34}{100}$ natural size. The names of the bones are indicated on the left side of the figure; of the scutes, on the right side. *ep.pl.*, epiplastron; *ent.pl.*, entoplastron; *hyo.pl.*, hyoplastron; *mes.pl.*, mesoplastron; *hyp.pl.*, hypoplastron; *xi.pl.*, xiphiplastron; *i.gu.*, intergular; *gu.*, gular; *hum.*, humeral; *pect.*, pectoral; *ab.d.*, abdominal; *fem.*, femoral; *an.*, anal.

to that of the hinder lobe. From this ridge the lower surface slopes upward and outward to the borders of the plastral bones. The bridge has a fore and aft extent of 87 mm. The anterior lobe is short and narrow. The length is 52 mm.; the width at the base, 72 mm.; at the hinder ends of the epiplastra, 38 mm. The latter bones are small and they meet along the midline, in front of the entoplastron,

only 5 mm. The entoplastron is relatively large, the length being 28 mm.; the width, 17 mm. Seen from the upper surface, this bone is broadly spear-shaped, with an anteriorly directed process, a longer one directed backward, and a right and a left process. Its length on this upper surface is 33 mm. The free borders of the anterior lobe are rounded in section. The thickness of the bones is about 7 mm.

On the upper surface of this plastron there is a low ridge passing from one axillary buttress to the other, making the thickness of the bone at the midline 9 mm. A similar thickening of the bone is found between the inguinal buttresses, the thickness becoming 11 mm.

The mesoplastral sutures (Fig. 2) are distinct everywhere, except near the midline in front of the right mesoplastron. The left mesoplastron is 21 mm. wide at the midline, and it appears to have had a width of about 43 mm. at the outer end. The mesoplastron of the right side is only 36 mm. wide at the outer end.

The hinder lobe is 83 mm. wide at the base. It is flat below. On the upper surface there is a thickening parallel with the free border on each side. From the summit of the ridge thus formed the surface slopes rapidly to the acute free border and more gently toward the midline. Just behind the inguinal notch the thickness of the bone is 14 mm.; where the hypo-xiphiplastral suture crosses the midline, only 4 mm. thick.

The sulci (Fig. 2) are usually distinctly developed. Those behind the intergulars are somewhat obscure. The intergulars do not separate the gulars. The various scutes meet their fellows along the midline as follows: intergulars, 12 mm.; gulars, 9 mm.; humerals, 32 mm.; pectorals, 41 mm.; abdominals, 27 mm.; femorals, 40 mm. The length of the anals is indeterminable. They lie partly on the hypoplastra. On each bridge there are three inframarginals, whose outer borders rested on the bridge peripherals.

The following table is intended to present the most obvious differences in the proportions of the plastral bones in the three species, *B. hatcheri*, *B. marshi* and *B. callosa*. The width of the bridge is taken as the unit.

| Dimensions. | <i>B. hatcheri.</i> | <i>B. marshi.</i> | <i>B. callosa.</i> |
|-----------------------|---------------------|-------------------|--------------------|
| Width of bridge. | 1.00 | 1.00 | 1.00 |
| Length anterior lobe. | .92 | .58 | .60 |
| Width " " | 1.00 | .79 | .82 |
| Width hinder " " | 1.04 | .75 | .94 |

It is seen that *B. hatcheri* has, relatively to the width of the bridge, large anterior and posterior lobes; that *B. marshi* has both lobes small; and that *B. callosa* has the anterior lobe short and of moderate width, while the hinder lobe is broad at the base.

The description of *B. marshi* will soon appear in the American Journal of Science.

The anterior lobe of the plastron of the present species is narrower and more pointed than that described by Lambe (Cont. Canad. Palaeont., iii, 1902, p. 44, fig. 9) under the name *Baena antiqua*.

AMERICAN MUSEUM NATURAL HISTORY,

May, 1904.

IV. A PRELIMINARY LIST OF THE HEMIPTERA OF WESTERN PENNSYLVANIA.

BY P. MODESTUS WIRTNER, O.S.B.

The enumeration of insects, even in merely preliminary lists, is of importance, because such lists assist in filling gaps in our knowledge of the uneven geographical distribution of genera and species. A list of the hemiptera found in the vicinity of Buffalo, N. Y., was published by Mr. E. P. VanDuzee in the year 1894. In the year 1899 Professor J. B. Smith published a list of the species known to occur in New Jersey. Nearer home we find another, but older, list of the hemiptera of Lancaster County, Pennsylvania, prepared by S. S. Rathvon, and published in 1869 in Mombert's History of that county. This list records a large number of hemiptera, but, unfortunately contains many useless manuscript names. The region west of Pittsburg is represented in the literature of this subject by a list of the hemiptera of Ohio published by Professor H. Osborn in 1900, and by lists of the hemiptera of Iowa published by the same authority at earlier dates. A list of the hemiptera of Colorado was published by Gillette and Baker in 1896.

The larger portion of the species enumerated in the present list were captured at Greensburg, Westmoreland County, Pennsylvania, during the seasons of 1900 and 1901, which were early and fine for collecting. A few more species were added in the late and wet season of 1902. Still fewer were added in the season of 1903, which was also late. The latter summer was made memorable to me by the flood which occurred on July 5 at Penn Station. My residence was inundated and the lower story was swept by muddy water five feet deep and most of my records were destroyed. Beatty, another locality mentioned in this list, is a railroad station about ten miles north of the Chestnut Ridge, and seven miles east of Greensburg, the county seat of Westmoreland County. Jeannette, likewise located in Westmoreland County (elevation 1,059 ft.), is separated from Greensburg (elevation 1,163 ft.), by a high ridge from which flow four streams.

Penn Station (elevation 974 ft.), one mile west of Jeannette and located on Brush Creek, is surrounded by many hills.

Patton is on the eastern slope of the Allegheny Mountains. Collections were made at this point at the "Beaver Dams," in meadows, and in open forests of pine and spruce. Portage is situated on the summit of the Allegheny Mountains. Collections were made here in open woods. Patton and Portage are both in Cambria County, Pennsylvania.

Wilmerding, on Brush Creek, is located in Allegheny County, and Charleroi in Washington County, Pennsylvania.

The insects taken at Jeannette were collected by Mr. Henry Klages; those taken at Wilmerding were collected by V. J. Zarobsky, an enthusiastic collector of all orders, and by Peter Forster, who is specially interested in coleoptera and lepidoptera. The species reported from Washington County were taken by Mr. George Ehrmann at Charleroi.

A few notes from the writings of our great hemipterist, Dr. Philip R. Uhler, have been added. The Pentatomidæ passed through the hands of Mr. E. P. VanDuzee. The greater portion of the beautiful family Capsidæ were submitted to Mr. Otto Heidemann, of Washington D. C., who kindly identified them. Many species were most obligingly identified by Professor H. Osborn. Nearly all of the Jassidæ were identified by Professor E. D. Ball, a specialist in this group of insects, from whose writings I have taken the liberty of extracting a few notes.

In the heteroptera I have followed the order of genera given in the catalogue of Lethierry and Severin. However, I have followed Dr. Uhler's method of writing the subfamilies, which Comstock's "Manual for the Study of Insects," p. 8, says "is now almost universally followed."

HEMIPTERA.

HETEROPTERA.

Family PENTATOMIDÆ.

Subfamily CORIMELÆNINÆ.

Genus CORIMELÆNA White.

1. *C. unicolor* Palisot Beauvois.

Beatty, Greensburg, June 3, August, September 25.

2. **C. anthracina** Uhler.

Jeannette.

3. **C. gilletti** VanDuzee.

Greensburg, May 2 ; June 18, 1902 ; Pittsburg.

4. **C. pulicaria** Germar.

Claridge, May 7, 1903 ; Greensburg, June 18, July 23, September 3.

Subfamily *SCUTELLERINÆ*.

Genus *AULACOSTETHUS* Uhler.

5. **A. marmoratus** Say.

Greensburg, October 31, 1900. Sweeping blueberry bushes. One specimen.

Genus *HOMÆMUS* Dallas.

6. **H. ænifrons** Say.

Patton, July 15, 1902. One specimen.

Genus *EURYGASTER* Castelnau.

7. **E. alternatus** Say.

Patton, July 15, 1902 ; Erie, August.

Subfamily *GRAPHOSOMINÆ*.

Genus *PODOPS* Castelnau.

8. **P. cinctipes** Say.

Penn Station, October 22, 1902. Sweeping weeds.

Subfamily *CYDNINÆ*.

Genus *GEOTOMUS* Mulsant et Rey.

9. **G. robustus** Uhler.

Greensburg, Jeannette.

Genus *AMNESTUS* Dallas.

10. **A. spinifrons** Say.

Greensburg, September 25, 1899. Uhler reports it from Maryland in March in decaying wood.

11. **A. pusillus** Uhler.

Claridge, May 7, 1903 ; Greensburg, May 11, September 25, 1900 ; Pittsburgh.

Genus SEHIRUS Amyot et Serville.

- 12.
- S. cinctus**
- Palisot Beauvois.

Greensburg, July 21, August. Sweeping a low weedy field.

Subfamily PENTATOMINÆ.

Genus BROCHYMENA Amyot et Serville.

- 13.
- B. arborea**
- Say.

Greensburg, September, 1900.

- 14.
- B. quadripustulata**
- Fabricius.

Beatty, Greensburg, August 6 to October 30, on oak.

Genus PERIBALUS Mulsant et Rey.

- 15.
- P. limbolarius**
- Stål.

Greensburg, May 17, July 23, September 25; Pittsburg.
Sweeping weeds.

Genus TRICHOPEPLA Stål.

- 16.
- T. semivittata**
- Say.

Greensburg, September 25, October 22, 1900.

Genus PENTATOMA Olivier.

- 17.
- P. (Chlorochroa) juniperina**
- Linnæus.

One specimen at Erie in July.

- 18.
- P. (Chlorochroa) ligata**
- Say.

One specimen at Greensburg.

Genus MORMIDEA Amyot et Serville.

- 19.
- M. lugens**
- Fabricius.

Patton, July; Jeannette, Greensburg, May 7 to August 18,
1900.

Genus CEBALUS Stål.

- 20.
- O. pugnax**
- Fabricius.

Greensburg, June to October 22. Uhler says that the species occurs in Maryland in low spots, where the plants grow richly and densely in the meadows. Garman records it as found on millet, *Setaria glauca*, and *Panicum sanguinale*.

Genus EUSCHISTUS Dallas.

21. **E. fissilis** Uhler.
Greensburg, August to September 30 ; Penn Station, May 16,
1903.
22. **E. tristigmus** Say.
Jeannette, Greensburg, August to October ; Penn Station, May
16, 1903.
23. **E. variolarius** Palisot Beauvois.
Patton, July 15 ; Greensburg, July to September.

Genus CCENUS Dallas.

24. **C. delius** Say.
Greensburg, July 1 to September 25 ; Patton, July 10, in
pasture fields.

Genus HYMENARCYS Amyot et Serville.

25. **H. æqualis** Say.
Greensburg, September 25. One specimen.
26. **H. nervosa** Say.
Greensburg, September 3. One specimen. Reported by
Uhler as occurring in Maryland on low and rank herbage in
meadows and about the skirts of woods.

Genus NEOTTIGLOSSA Kirby.

27. **N. undata** Say.
Greensburg, September 25, 1900. Two specimens.

Genus COSMOPEPLA Stål.

28. **C. carnifex** Fabricius.
Patton, July 25 ; Greensburg, July to September.

Genus MENECLIS Stål.

29. **M. insertus** Say.
Greensburg, September 25 ; Washington County.

Genus THYANTA Stål.

30. **T. custator** Fabricius.
Erie, July ; Greensburg, October 30. Rare.

Genus MURGANTIA Stål.

- 31.
- N. histrionica**
- Hahn.

About ten years ago the "Harlequin Cabbage Bug" was very common.

Genus NEZARA Amyot et Serville.

- 32.
- N. hilaris**
- Say.

Patton, Greensburg, Jeannette, and Pittsburgh. Common from June 2 to October on bushes and small trees.

Genus BANASA Stål.

- 33.
- B. calva**
- Say.

Washington County.

- 34.
- B. dimidiata**
- Say.

Greensburg, September; Patton, September 25.

Genus LIOTROPIS Uhler.

- 35.
- L. humeralis**
- Uhler.

Beatty, Greensburg, May 22, 1903, on low bushes. (On *Carya*, Uhler.)

Subfamily ASOPINÆ.

Genus MINEUS Stål.

- 36.
- M. strigipes**
- Herrich-Schæffer.

Jeannette.

Genus PODISUS Herrich-Schæffer.

- 37.
- P. cynicus**
- Say.

Jeannette, Greensburg, July to the end of September.

- 38.
- P. serieventris**
- Uhler.

Jeannette, Greensburg, September.

- 39.
- P. modestus**
- Dallas.

Patton, June 19, Sept. 25, 1902; Erie, Greensburg, August 28, September 3, 1901.

- 40.
- P. maculiventris**
- Say.

Patton, June 19, September 25, 1902; Erie, Jeannette, Greensburg, August and September. Also Washington County.

The above four species hibernate. They have been recorded as feeding upon insects almost exclusively, and are very beneficial.

Subfamily *ACANTHOSOMINÆ*.Genus *ACANTHOSOMA* Curtis.41. *A. lateralis* Say.

Greensburg. One specimen.

Family *COREIDÆ*.Subfamily *MEROCORINÆ*.Genus *CORYNOCORIS* Mayr.42. *C. distinctus* Dallas.

Greensburg, September 25 to October 9, 1901. Sweeping bushes, and golde-nrod near Oakford Park. Uhler's record for Maryland is "in corners of fields adjoining woods where small weeds and shrubs grow luxuriantly."

Subfamily *MICTINÆ*.Genus *ACANTHOCERUS* Palisot Beauvois.43. *A. galeator* Fabricius.

Greensburg, June, August 22, September 16, October 22, on wild grape vines. ("On blackberry bushes," *Uhler*.)

Subfamily *ACANTHOCEPHALINÆ*.Genus *ACANTHOCEPHALA* Castelnau44. *A. (Metapodius) terminalis* Dallas.

Greensburg, May 16, July 10, August 22, October 9; Pittsburgh. On wild grapes. Uhler reports it as found on bushes and branches on the border of oak woods.

Subfamily *ANISOSCELINÆ*.Genus *LEPTOGLOSSUS* Guérin.45. *L. corculus* Say.

Beatty, 1900. On oak.

46. *L. oppositus* Say.

Jeannette, Greensburg, October 22, 1900. Beating trees at the edge of woods.

47. *L. sp.?*

Jeannette.

Subfamily *CHARIESTERINÆ*.Genus *CHARIESTERUS* Castelnau.48. *C. antennator* Fabricius.

Greensburg, July to October 22, 1900. Sweeping golden-rod and bushes near Oakford Park.

Subfamily *CENTROSCELINÆ*.Genus *ANASA* Amyot et Serville.49. *A. tristis* De Geer.

The common "Squash-bug" is found all over Westmoreland County, and also in Allegheny and Washington Counties. Mr. Henry Klages (Jeannette) found them by the hundreds under the bark of an old tree in mid-winter.

50. *A. armigera* Say.

Jeannette (Klages). One specimen.

51. *A. repipta* Uhler (MS.).

Jeannette (Klages). One specimen.

Subfamily *ALYDINÆ*.Genus *ALYDUS* Fabricius.52. *A. eurinus* Say.

Patton, July 15, Greensburg, July 27. Usually on golden-rod.

53. *A. conspersus* Montandon.

Patton, July 15, Greensburg, July 2 to September. On golden-rod.

Genus *MEGALOTOMUS* Fieber.54. *M. quinque-spinosus* Say.

Pittsburgh.

Subfamily *CORIZINÆ*.Genus *HARMOSTES* Burmeister,55. *H. reflexulus* Say.

Penn Station, May 16, 1903; Greensburg, July 23 to September 21, 1902; Jeannette, August 15. In weedy fields.

Genus CORIZUS Fallén.

56. **C. lateralis** Say.

Beatty, Greensburg. On rank growths at the edge of woods. Uhler reports two broods in Maryland, the first from May to July, the second from August to October.

57. **C. nigristernum** Signoret.

Penn Station, May 11, 1903; Jeannette, Greensburg, July 23, September 21, 1901. Found in company with *lateralis*.

Family BERYTIDÆ.

Subfamily BERYTINÆ.

Genus NEIDES Latreille.

58. **N. muticus** Say.

Greensburg, June 2, 19, 1901; Patton, September 25, 1903.

Subfamily METACANTHINÆ.

Genus JALYSUS Stål.

59. **J. spinosus** Say.

Penn Station, May 10, 1903; Greensburg, July 30, August 25, 1901; Pittsburgh. More abundant than *N. muticus*, both usually found at the edge of woods and in weedy fields.

Family LYGÆIDÆ.

Subfamily LYGÆINÆ.

Genus ONCOPELTUS Stål.

60. **O. fasciatus** Dallas.

Jeannette, October 4, 1901, one specimen; Pittsburgh. Uhler records it as found on the purple asclepias.

Genus LYGÆUS Fabricius.

61. **L. bicrucis** Say.

There is one specimen in the collection of the Carnegie Museum.

62. **L. reclavatus** Say.

Rare at Greensburg and Jeannette.

63. **L. turcicus** Fabricius.

Common everywhere during the whole summer.

Genus NYSIUS Dallas.

64. **N. angustatus** Uhler.
Greensburg, June and July.
65. **N. providus** Uhler.
Penn Station, May 25, 1903; Greensburg, July 19, 1901.

Genus BELONCHILUS Uhler.

66. **B. numenius** Say.
Greensburg, one specimen; Penn Station, August 10, 1904.
Sweeping weeds along Brush Creek.

Subfamily CYMINÆ.

Genus ISCHNORHYNCHUS Fieber.

67. **I. resedæ** Panzer (*didymus* Zetterstedt).
Greensburg, June 3, September, 1900. On low bushes at the edge of woods.

Genus CYMUS Hahn.

68. **C. luridus** Stål.
Portage. One specimen in open woods.
69. **C. angustatus** Stål.
Penn Station, Greensburg, June 2, 1901; Patton, June 19 to July 15; Claridge, May 7, 1903. Usually in damp situations.

Subfamily BLISSINÆ.

Genus BLISSUS Klug.

70. **B. leucopterus** Say.
Greensburg, Patton, June 19, 1903. The long- and short-winged forms of the Chinch-bug appear to be rare here.

Subfamily GEOCORINÆ.

Genus GEOCORIS Fallén.

71. **G. ater** Fabricius (*fuliginosus* Say).
Penn Station, May 25, 1903; Greensburg, September 21.
Among the roots of grass in sandy soil.
72. **G. limbatus** Stål.
Greensburg, September 1, 1901.

Subfamily *PACHYGRONTHINÆ*.

Genus PHLEGYAS Stål.

- 73.
- P. annulicrus*
- Stål (
- abbreviata*
- Uhler).

Beatty, Jeannette, Greensburg, May 16, June 3. Uhler records it on red clover and small bushes; also where weeds grow rankly, forming the undergrowth of open woods.

CEDANCALA Amyot et Serville.

- 74.
- O. dorsilinea*
- Amyot et Serville (
- dorsalis*
- Say).

Patton, June 19, Penn Station, May 25, 1903, Greensburg, June 2 to August 25, 1901. In swampy pastures and in woods.

Subfamily *OXYCARININÆ*.

Genus CROPHIUS Stål.

- 75.
- C. disconotus*
- Say.

Jeannette, near Oxford Park. One example. Mr. E. P. VanDuzee had taken it in numbers at Kinzua Bridge, Pa., on golden-rod in September.

Subfamily *APHANINÆ*.

Genus LIGYROCORIS Stål.

- 76.
- L. sylvestris*
- Linnæus.

Jeannette, Greensburg, September 23, October 23, 1901. Uhler reports the species as found in Maryland in wild grassy spots adjacent to sphagnum swamps.

Genus PERIGENES Distant.

- 77.
- P. species nova?*

Greensburg.

Genus MYODOCHA Latreille.

- 78.
- M. serripes*
- Olivier.

Jeannette, Greensburg, September, October. In meadows; also found hibernating under stones and bark.

Genus HERÆUS Stål.

- 79.
- H. plebejus*
- Stål.

Greensburg, June 18.

Genus PAMERA Say.

80. **P. basalis** Dallas.

Greensburg, September 16, October 9, and 23, 1901. In meadows, later under stones.

Genus PLOCIOMERA Say.

81. **P. nodosa** Say.

Greensburg, September 1, 1901; Jeannette. Klages tells me he finds it abundantly on the mushrooms on trees.

Genus PHYGÆUS Uhler.

82. **P. pallidus** Uhler.

Greensburg, Jeannette, September. Not common. Captured at Penn Station, August 1, 1904, under a cluster of dry grass in an old field in company with *C. mavortius* Say.

Genus CNEMODUS Herrich-Schaeffer.

83. **C. mavortius** Say.

Penn Station, August 1, 1904. In an old, neglected, dry field under a cluster of bunched grasses. One specimen has the membrane as long as the abdomen.

Genus OZOPHORA Uhler.

84. **O. picturata** Uhler.

Jeannette. One specimen.

Genus RHYPAROCHROMUS Curtis.

85. **R. (*Megalonotus*) unus** Say.

Greensburg, September 9, 1901. A specimen from Beatty is twice as large as any from Greensburg.

Genus SPHRAGISTICUS Stål.

86. **S. nebulosus** Fallén.

Greensburg.

Genus DELOCHILOCORIS Berg (*Dorochosa* Distant).87. **D. illuminata** Distant.

Greensburg. One specimen.

Family CAPSIDÆ.

Tribe Fulviaria.

Genus FULVIUS Stål.

88. **F. heidemanni** Reuter.

Jeannette.

Tribe Miraria.

Genus MIRIS Fabricius.

89. **M. instabilis** Uhler.

Claridge, May 7, 1903; Greensburg, October; Patton, July 15, 1901. Common.

Genus BRACHYTROPIS Fieber.

90. **B. calcarata** Fallén.

Greensburg, May 20, July 23, October 22, 1900. In meadows.

Genus MEGALOCERÆA Feiber.

91. **M. ruficornis** Fallén.

Greensburg, July 25.

Genus COLLARIA Provancher.

92. **C. oculata** Reuter.

Patton, June 19, July 15; Greensburg, June 2 to September 10. Feeding on rich grass.

Genus LEPTOPTERNA Fieber.

93. **L. dolabrata** Linnæus.

Greensburg, June 2, July; Patton, July 15, September 10, 1903; Pittsburgh. Common in hay-fields.

Tribe Bryocoraria.

Genus MONALOCORIS Dahlbom.

94. **M. filicis** Linnæus.

Patton, July, September 10, 1903. On pine.

Genus ECCRITOTARSUS Stål.

95. **E. elegans** Uhler.

Greensburg. Occasionally from August to October in clover-fields.

Genus PYCNODERES Guérin.

96. **P. insignis** Reuter.

Patton, September 25, 1902. On pine.

Tribe Cylaparia.

Genus CYLAPUS Say.

97. **C. tenuicornis** Say.

Patton, August. Heidemann reports this insect as taken on dead oaks.

Tribe Capsaria.

Genus LYGUS Hahn.

98. **L. pabulinus** Linnæus.

Beatty, Greensburg, June to August. In tall grass in damp places.

99. **L. pratensis** Linnæus.

Everywhere on mullein in March, and thereafter to November on grass and weeds.

100. **L. monachus** Uhler.

Patton, June 19, 1903. A few specimens on maples.

101. **L. invitus** Say.

Greensburg, June, July. On grapes. One specimen of the dark form was captured.

102. **L. species nova?**

Patton, June 19, 1903. On maples.

Genus SYSTRATIOTUS Douglas & Scott.

103. **S. americanus** Reuter.

Greensburg, June 9, 1901.

Genus PÆCILOSCYTUS Fieber.

104. **P. basalis** Reuter.

Greensburg, May, July. On thistles and weeds in an old field.

Genus TROPIDOSTEPTES Uhler.

105. **T. cardinalis** Uhler.

Greensburg. Common in June.

Genus CAMPTOBROCHIS Fieber.

- 106.
- C. nebulosus**
- Uhler.

Greensburg, June to September 2.

- 107.
- C. grandis**
- Uhler.

Greensburg, June, July. Found with the former species on trees.

Genus PCEILOCAPSUS Reuter.

- 108.
- P. lineatus**
- Fabricius.

Last May I saw this species by the hundreds on the leaves of burdock in an open woods. I captured it also in June at Greensburg and Jeannette. There are specimens taken in Pittsburgh in the Carnegie Museum.

- 109.
- P. goniphorus**
- Say.

Greensburg, May to July in rich meadows; Jeannette; Pittsburgh.

- 110.
- P. affinis**
- Reuter.

Greensburg, June.

- 111.
- P. marginalis**
- Reuter.

Greensburg, June. Not as abundant as the other species.

Genus GARGANUS Stål.

- 112.
- G. fusiformis**
- Say.

Greensburg. Common in fields of clover and on weeds.

Genus CALLICAPSUS Reuter.

- 113.
- C. histrio**
- Reuter.

Jeannette.

Genus NEOBOROPS Uhler.

- 114.
- N. vigilax**
- Uhler.

Beatty, Jeannette.

Genus NEOBORUS Distant.

- 115.
- N. saxeus**
- Distant.

Patton, June 19, 1903. On pine. Greensburg. Reported as common on linden.

- 116.
- N. species nova?**

Patton, June.

Genus COCCOBAPHES Uhler.

- 117.
- C. sanguinarius**
- Uhler.

Jeannette, Greensburg, July 3, 1901; Pittsburgh.

Genus EUARMOSUS Reuter.

- 118.
- E. sayi**
- Reuter.

Rare at Greensburg. Found also in Washington County.

Genus CAPSUS Stål.

- 119.
- C. ater**
- Linnaeus.

Patton, June 19, 1903; Greensburg, July 3, in Huff Park.

Genus STENOTUS Jakowleff.

- 120.
- S. binotatus**
- Fabricius.

Patton, June 19, 1903; Greensburg, July 10, 1901. In meadows.

Genus MELINNA Uhler.

- 121.
- M. modesta**
- Uhler.

Patton, July; Portage, August 2, on pine. Greensburg, July 23, a dark variety on oak.

- 122.
- M. species nova?**

Greensburg, October 9, 1901.

Genus MEGACÆLUM Fieber.

- 123.
- M. species nova?**

One specimen.

Genus CALOCORIS Fieber.

- 124.
- C. rapidus**
- Say.

Common in fields everywhere July to September.

Genus COMPSOCEROCORIS Reuter.

- 125.
- C. annulicornis**
- Reuter.

Greensburg. One specimen.

Genus NEUROCOLPUS Reuter.

- 126.
- N. nubilis**
- Say.

Greensburg, June and July on grape-vines. Portage, August 9, on sumach.

Genus PHYTOCORUS Fabricius.

127. **P. eximius** Reuter.
 Patton, June 19, July 15, 1903; Greensburg, July 3, September; Portage; Pittsburgh. On hickory.
128. **P. tibialis** Reuter.
 Greensburg. Rare.
129. **P. puella** Reuter.
 Greensburg, July 3 to September 10. On oak.
130. **P. colon** Say.
 Greensburg, July 25, 1902. On *Rhus toxicodendron*.
131. **P. scrupeus** Say.
 Greensburg, June 8; Pittsburgh. On grape-vines.

Tribe Loparia.

Genus RESTHENIA Spinola.

132. **R. insitiva** Say.
 Jeannette, Washington County.
133. **R. maculicollis** Reuter.
 Greensburg, July 23, 1901. On grapes. Rare.
134. **R. circumcincta** Say.
 Jeannette. One specimen.

Genus LOPIDEA Uhler.

135. **L. media** Say var. **robiniae** Uhler.
 Greensburg, July, August. On blue-grass.
136. **L. species nova?**
 Greensburg.

Tribe Philophoraria.

Genus PHILOPHORUS Hahn.

137. **P. walshii** Uhler.
 Portage, August 2.
138. **P. amemus** Uhler.
 Patton, July 15, September 24, 1902. On pine.

Tribe Laboparia.

Genus HALTICUS Burmeister.

139. **H. uhleri** Girard.
 Greensburg, May 12, June 18, August 27 to October. The

apterous form the commoner. Found in fields, especially when the grain has been cut.

140. **H. intermedius** Uhler.

Patton, July 15, 1903.

Genus **STRONGYLOCORIS** Costa.

141. **S. stygica** Say.

Greensburg; June 3, 1901; Patton, July 15.

Tribe **Dicypharia**.

Genus **DICYPHUS** Fieber.

142. **D. californicus** Stål.

Greensburg, in May on blackberry blossoms, in August and September on shrubs and weeds; Pittsburgh.

143. **D. famelicus** Uhler.

Greensburg, October 22, 1900. Among weeds in a fence corner on the south side of woods.

Genus **HYALIODES** Reuter.

144. **H. vitripennis** Say.

Greensburg, July to September. On weeds and shrubs at the edge of woods.

Tribe **Cyllocoraria**.

Genus **DIAPHNIDIA** Uhler.

145. **D. pellucida** Uhler.

Greensburg, July 22, September 3.

146. **D. species nova?**

One specimen at Wilmore, August 16.

Genus **ORTHOTYLUS** Fieber.

147. **O. species nova?**

Greensburg, May 22.

Genus **ILNACORA** Reuter.

148. **I. malina** Uhler.

Penn Station, May 25, 1903. Sweeping weeds near the creek.

149. **I. stali** Reuter.

Greensburg, July 12, 1901. On rank weeds in damp situations.

Genus MALACOCORIS Fieber.

150. **M. irroratus** Say.
Greensburg, July 31.

Tribe Oncotylaria.

Genus MACROCOLEUS Fieber.

151. **M. coagulatus** Uhler.
Greensburg, July 25, 1901. Sweeping a fence corner in a corn field.

Genus MACROTYLUS Fieber.

152. **M. vestitus** Uhler.
Greensburg, June 19. On wild cherry trees.

Tribe Herdoniaria.

Genus XENETUS Distant.

153. **X. scutellatus** Uhler.
Greensburg, May and June; Pittsburg. On oak.

Tribe Plagiognatharia.

Genus PLAGIOGNATHUS Fieber.

154. **P. annulatus** Uhler.
Greensburg, July and August. In clover-fields.
155. **P. fraternus** Uhler.
Greensburg, June to September 3, 1901; Patton, June 19, 1903, on beech-trees.
156. **P. politus** Uhler.
Greensburg, July 3, 22, 1901.

Genus CHLAMYDATUS Curtis.

157. **C. associatus** Uhler.
Greensburg, June to September. Common.
158. **C. suavis** Reuter.
Jeannette, August 15, 1901.

Genus STRONGYLOTES Reuter.

159. **S. saliens** Reuter.
Greensburg, June 3, 1901.

Genus RHINACLOA Reuter.

160. **R. forticornis** Reuter.

Greensburg, July to September. Common in hay-fields; abundant in fields where the grain has been cut.

Genus PHYLUS Hahn.

161. **P. modestus** Uhler.

Greensburg, July 1, 1901.

Family TINGITIDÆ.

Subfamily PIESMINÆ.

Genus PIESMA Lepéllétier et Serville.

162. **P. cinerea** Say.

Greensburg, May 7, 1901. August to November. Common on shrubs and trees.

Subfamily TINGITINÆ.

Genus CORYTHUCA Stål.

163. **C. ciliata** Say.

Greensburg, May to November. On sycamore (*Platanus*).

164. **C. arcuata** Say.

Greensburg, May to November. On hawthorn (*Crataegus*).

Genus LEPTOBYRSA Stål.

165. **L. Species nova?**

Patton, June, 1903. Many adults, but few nymphs on the food-plant, which is laurel (*Kalmia latifolia*). August 2, 1901, I took it at Portage on laurel, but found no nymphs.

Genus GARGAPHIA Stål.

166. **G. fasciata** Stål.

Greensburg, July, August. On linden.

Genus PHYSATOCHILA Fieber.

167. **P. plexa** Say.

Greensburg, June 18, 1901.

Genus LEPTOYPHA Stål.

- 168.
- L. mutica**
- Say.

Greensburg, June 18, 1901.

Family PHYMATIDÆ.

Genus PHYMATA Latreille.

- 169.
- P. erosa-pennsylvanica**
- Handlirsch. (Monographie der Phymatiden, Annalen des K. K. Natur. Hofmuseums, Wien, Band XII, 1897, p. 163.)

Patton, Jeannette, Greensburg, Pittsburgh, July 2 to end of September. On golden-rod.

Family ARADIDÆ.

Subfamily ARADINÆ.

Genus ARADUS Fabricius.

- 170.
- A. æqualis**
- Say.

Beatty, Wilmerding.

- 171.
- A. quadrilineatus**
- Say.

Jeannette, Penn Station, April 20, 1903. On oak.

- 172.
- A. similis**
- Say.

Wilmerding.

- 173.
- A. acutus**
- Say.

Beatty.

- 174.
- A. crenatus**
- Say.

Beatty, Wilmerding.

- 175.
- A. Species nova?**
- One specimen found at Patton on pine.

Subfamily BRACHYRHYNCHINÆ.

Genus NEUROCTENUS Fieber.

- 176.
- N. simplex**
- Uhler.

Beatty, Greensburg, April, May; Wilmerding (*Forster*); Pittsburgh.

Genus ANEURUS Curtis.

- 177.
- A. inconstans**
- Uhler.

Patton, July 15, 1902.

Family **HEBRIDÆ**.Genus **HEBRUS** Curtis.

- 178.
- H. americanus**
- Uhler.

Greensburg, July 10 to October 13.

Family **HYDROMETRIDÆ**.Subfamily *HYDROMETRINÆ*.Genus **HYDROMETRA** Latreille.

- 179.
- H. lineata**
- Say.

Pittsburgh ; Beatty.

Subfamily *VELIINÆ*.Genus **RHAGOVELIA** Mayr.

- 180.
- R. obesa**
- Uhler.

North of Jeannette on the smooth waters of the creek during the month of October. No winged form found.

Subfamily *GERRINÆ*.Genus **GERRIS** Fabricius.Subgenus **HYDROTRECHUS** Stål.

- 181.
- H. remigis**
- Say.

Portage, August 2, 1901. Greensburg, April, July to cold weather. Pittsburgh.

Subgenus **LIMNOTRECHUS** Stål.

- 182.
- L. marginatus**
- Say.

Penn Station, April ; Beatty, Greensburg, March 29, 1897.

Subgenus **LIMNOPORUS** Stål.

- 183.
- L. rufoscutellatus**
- Latreille.

Greensburg, Penn Station. Not common.

Genus **STEPHANIA** White.

- 184.
- S. picta**
- Herrich-Schæffer.

North of Jeannette, October 13, 1901. All without wings.

Family HENICOCEPHALIDÆ.

Genus HENICOCEPHALUS Westwood.

185. **H. culicis** Uhler.

Greensburg, June. Sweeping shrubs and weeds in the old cemetery.

Family REDUVIIDÆ.

Subfamily EMESINÆ.

Genus PLCEARIODES B. White.

186. **P. erabundus** Say.

One specimen attracted by light at St. Vincent's College, Beatty, in May.

Genus EMESA Fabricius.

187. **E. longipes** De Geer.

Greensburg, August 20, 1901. Sweeping high weeds in an open woods.

Subfamily SAICINÆ.

Genus ONCEROTRACHELUS Stål.

188. **O. acuminatus** Say.

Beatty.

Subfamily STENOPODINÆ.

Genus PYGOLAMPIS Germar.

189. **P. pectoralis** Say.

Greensburg; Pittsburgh, June; Penn Station, June 20, 1904, on the lawn at the rear of my house, on blue-grass.

Subfamily ACANTHASPINÆ.

Genus REDUVIUS Lamarck.

190. **R. personatus** Linnæus.

One specimen of the "Bed-bug Hunter" was found at Jeanette.

Genus CONORHINUS Castelnau.

191. **C. sanguisugus** Leconte.

The "Kissing-bug" has been found at Beatty and at Wilmerding. It was also found in Washington County, December 18, in the stump of an old ash tree in company with the nymphs.

Subfamily *PIRATINÆ*.Genus *MELANOLESTES* Stål.

192. **M. picipes** Herrich-Schæffer.
Jeannette ; Pittsburgh.
193. **M. abdominalis** Herrich-Schæffer.
Jeannette.

Subfamily *HARPACTORINÆ*.Genus *ZELUS* Fabricius.

194. **Z. exsanguis** Stål.
Greensburg, August. On small trees.
195. **Z. luridus** Stål.
Jeannette ; Greensburg, June 2, July. Often associated with the former species.

Genus *FITCHIA* Stål.

196. **F. nigrovittata** Stål.
Greensburg ; Patton, July 15, 1902.

Genus *ARILUS* Hahn.

197. **A. cristatus** Linnæus.
Mr. Klages, of Jeannette, informs me that he, as well as the late Dr. John Hamilton, took this species in the vicinity of Pittsburgh.

Genus *ACHOLLA* Stål.

198. **A. multispinosa** De Geer.
Beatty ; Greensburg, August 5, 1901 ; Pittsburgh. On trees.

Genus *SINEA* Amyot et Serville.

199. **S. diadema** Fabricius.
Greensburg, September 25. Beating trees and golden-rod.

Subfamily *NABINÆ*.Genus *NABIS* Latreille.

200. **N. subcoleopratus** Kirby.
Patton, July 15 ; Greensburg, September ; Jeannette. One macropterous example was taken at Wilmerding by Zarobsky. It is found on bushes and weeds and on golden-rod.

201. **N. ferus** Linnæus.

Greensburg, July to October. In damp localities, especially in damp woods.

202. **N. kalmi** Reuter.

Greensburg, July to September. The apterous form occurs in deep damp woods. Patton, September 25, 1902.

Family SALDIDÆ.

Subfamily *SALDINÆ*.

Genus *SALDA* Fabricius.

203. **S. interstitialis** Say.

Greensburg, July 10. Professor Webster is writing a paper on this genus and has several other species which belong here.

Family CIMICIDÆ.

Genus *CIMEX* Linnæus.

204. **C. lectularius** Linnæus.

The bed-bug is also found here.

Family ANTHOCORIDÆ.

Subfamily *ANTHOCORINÆ*.

Genus *LYCTOCORIS* Hahn.

205. **L. campestris** Fabricius.

Jeannette.

Genus *PIEZOSTETHUS* Fieber.

206. **P. sordidus** Reuter.

Penn Station, June 20, 1903. Adults and nymphs under the bark of a log of oak.

Genus *TRIPHLEPS* Fieber.

207. **T. insidiosus** Say.

Common everywhere on flowers from May to the end of the season.

Family GALGULIDÆ.

Genus *PELOGONUS* Latreille.

208. **P. americanus** Uhler.

Greensburg, July 10, 1901. It was found in Huff Park in

muddy spots among the grass on the banks of the creek, where the stream overflows when the water is high.

Genus *GALGULUS* Latreille.

209. *G. oculatus* Fabricius.
Washington County. October.

Family BELOSTOMATIDÆ.

Genus *ZAITHA* Amyot et Serville.

210. *Z. fluminea* Say.
Jeannette.

Genus *BENACUS* Stål.

211. *B. griseus* Say.
Wilmerding, Jeannette, Pittsburgh. Under electric lights.

Family NEPIDÆ.

Genus *NEPA* Fabricius.

212. *N. apiculata* Uhler.
Wilmerding.

Family NOTONECTIDÆ.

Genus *NOTONECTA* Linnæus.

213. *N. undulata* Say.
St. Vincent's College, Beatty, October 26, in the pond of a brick-yard.
214. *N. irrorata* Uhler.
Captured with the preceding species.

Genus *ANISOPS* Spinola.

215. *A. platycnemis* Fieber.
Taken with *N. undulata*.

Family CORISIDÆ.

Genus *CORISA* Geoffroy.

216. *C. alternata* Say.
Greensburg, October 26, 1901. Taken in fresh water.

HOMOPTERA.

Family CICADIDÆ. (THE CICADAS.)

Genus TIBICEN Latreille.

217. **T. septendecim** Linnæus.

Professor P. J. Schmitt of St Vincent's College, Beatty, informed me that the "Seventeen-year Locust" or "Periodical Cicada" appeared on the grounds of the College in 1898 in small numbers. The regular brood appeared in May, 1900. Beginning at Sheridan, Cambria County, I noticed it as far west as Pittsburgh, as far north as Vandergrift, and as far south as Scottdale. How far it extended beyond these limits I am unable to state. The dwarfed form (var. *cassina* Fisher), seemed to be the common form.¹

Genus CICADA Linnæus.

218. **C. tibicen** Linnæus.

Beatty, Jeannette, Wilmerding, Pittsburgh. Common everywhere.

219. **C. canicularis** Harris.

This species occurs with the preceding.

Family MEMBRACIDÆ. (THE TREE-HOPPERS.)²

Genus ENTYLIA Burmeister.

220. **E. sinuata** Fabricius.

Beatty, Greensburg, May 16, 1901. On grape vines. (Potato, ragweed, sunflower, spikenard.)

221. **E. bactriana** Germar.

Washington County; Greensburg, May 16, June 2, 1903. On weeds, most frequent at the edge of woods.

¹ The editor of the ANNALS in the spring of 1900 sent out a circular asking for information as to the appearance of the Periodical Cicada, and received numerous replies showing that the brood extended over the whole of western Pennsylvania from Cambria county in the east to the state-line and beyond it into Ohio as far west as Youngstown and Poland; and from Grafton and Parkersburg, West Virginia, in the south to Venango County, Pennsylvania, in the north. The brood probably extended somewhat beyond these points, but no replies beyond them were received. The insects were particularly numerous in the "Panhandle" of West Virginia.

W. J. HOLLAND.

² The food-plants cited in brackets are those given by F. W. Goding, Insect Life, Vol. V, p. 92.

Genus PUBLILIA Stål.

222. **P. concava** Say.

Greensburg, May and June, 1902. On weeds. (Grass, Canada-thistle.)

223. **P. nigridorsum** Goding.

Greensburg, June 3, 1903. On weeds and thistles.

Genus CERESA Amyot et Serville.

224. **C. diceros** Say.

Patton, July 15, 1902; Jeannette, Greensburg, Portage, August. On weeds and low bushes, especially on low growths of wild cherry.

225. **C. bubala** Fabricius.

Greensburg, Beatty, June and July; Portage, August 2, 1900; Washington County; Pittsburgh. On various bushes and trees, particularly wild cherry. (Apple, potato, tomato, pear, peach, plum, grape, almond, willow, locust, Japan-lily, grass.)

226. **C. taurina** Fitch.

Portage, August 2, 1902; Greensburg, August 15, 1902. On weeds.

227. **C. basalis** Walker.

Portage, August 2; Patton, September 10, 1903. On low bushes.

228. **C. vitula** Fabricius.

Greensburg, May 17, August 15, 1901; Patton, September 10, 1903; Washington County; Pittsburgh. On walnut and low bushes.

Genus STICTOCEPHALA Stål.

229. **S. inermis** Fabricius.

Greensburg, Huff Park, July 12, 1900. On weeds in damp places. (Plum, oats, oak, alfalfa, grass.)

230. **S. lutea** Walker.

Greensburg, May, July 19. Breeding on young chestnut trees. Swept from weeds. (Wheat.)

Genus THELIA Amyot et Serville.

231. **T. bimaculata** Fabricius.

Greensburg, July; Pittsburgh. On locust. (Elder, black willow.)

232. **T. cratægi** Fitch.

Jeannette, Portage, August, 1902. On hawthorn. (Oak, apple.)

Genus TELAMONA Fitch.

233. **T. reclinata** Fitch.

Greensburg. On oak.

234. **T. monticola** Fabricius.

Greensburg, July 10; Portage, August 2, 1900; Pittsburgh. On oak. (Linden.)

235. **T. concava** Fitch.

Chestnut Ridge near Lycippus; Jeannette.

236. **T. fasciata** Fitch.

Jeannette, Greensburg, July. On hickory. (Grape, ampelopsis.)

Genus HELIRIA Stål.

237. **H. scalaris** Fairmaire.

Greensburg, July 10; Wilmerding (Peter Forster). On crab-apple. (Beech.)

Genus ARCHASIA Stål.

238. **A. galeata** Fabricius.

Greensburg. On oak. Wilmerding (V. J. Zarobsky). (Eupatorium, verbena, oak.)

Genus SMILIA Germar.

239. **S. camela** Fabricius.

Greensburg, June 18, mating on oak; Wilmerding, July; Pittsburgh.

Genus ACUTALIS Fairmaire.

240. **A. calva** Say.

Beatty, Greensburg, July 19 to September 21. On weeds. (Eupatorium, honey-locust.)

Genus CYRTOLOBUS Goding.

241. **C. muticus** Fabricius.

Jeannette, Greensburg, June 3, 1903. On trees.

242. **C. fenestratus** Fitch.

Washington County; Jeanette, Greensburg, June and July. Common on oak.

243. **C. vau** Say.
Greensburg. One specimen on chestnut. (Walnut, hickory, oak.)
244. **C. trilineatus** Say.
Greensburg. On oak.
245. **C. sculptus** Fairmaire.
Greensburg. Two specimens.

Genus ATYMNA Say.

246. **A. inornata** Say.
Greensburg. On oak. (Chestnut, linden, hickory.)
247. **A. castanea** Fitch.
Greensburg, Charleroi, Pittsburgh. On chestnut.
248. **A. querci** Fitch.
Found in the same localities as the preceding species. On oak.

Genus OPHIDERMA Fairmaire.

249. **O. salamandra** Fairmaire.
Jeannette, Greensburg, Pittsburgh, July. On oak.
250. **O. flaviguttula** Goding.
Greensburg, July. On oak.
251. **O. flava** Goding.
Greensburg, June 3, July 10. On laurel-oak.
252. **O. flavicephala** Goding.
Greensburg, June 18. On laurel-oak.

Genus VANDUZZEA Goding.

253. **V. arquata** Say.
Greensburg, June 16 to July 1, 1901; followed later by another brood. Washington County; Pittsburgh. On honeylocust (*Gleditschia*).

Genus CARYNOTA Fitch.

254. **C. mera** Say.
Cambria, Westmoreland, Washington, and Allegheny Counties, July to September 10. On oak.

Genus ENCHENOPA Amyot et Serville.

255. **E. binotata** Say.
Greensburg, July 10 to September. On butternut and locust.

(Birch, apple, walnut, grape, *Ptelea trifoliata*, *Cercis*, viburnum, Ceanothus, weeds.)

Genus *CAMPYLENCHIA* Stål.

256. *C. curvata* Fabricius.

Patton, Jeannette, Greensburg, July and August. On weeds and bushes.

Genus *MICROCENTRUS* Stål.

257. *M. caryæ* Fitch.

Patton, Jeannette, Greensburg, July and August. On hickory and walnut.

Family **FULGORIDÆ.** (THE LANTERN-FLIES.)

Subfamily *FLATINÆ.*

Genus *ORMENIS* Stål.

258. *O. pruinosa* Say.

Greensburg, August 25, September 2, 1901. On grape, oak, small trees and shrubs.

Genus *PŒCIOPTERA* Latreille.

259. *P. septentrionalis* Spinola.

Greensburg, August and September. On grape-vines and small trees.

Genus *AMPHISCEPA* Germar.

260. *A. bivittata* Say.

Greensburg, July 23, August 25, 1901; Pittsburgh. On small trees and in the grass. Several specimens of the red variety were taken on August 8 and September 9, 1901, at Greensburg.

Genus *HELIPTERA* Amyot et Serville.

261. *H. pallida* Say.

Greensburg. Sweeping grass.

262. *H. opaca* Say.

Greensburg.

Subfamily *ISSINÆ.*

Genus *BRUCHOMORPHA* Newman.

263. *B. oculata* Newman.

Greensburg, September; Pittsburgh. Both forms occur on blue-grass.

Genus THIONIA Stål.

- 264.
- T. bullata**
- Say.

Charleroi.

Subfamily CALOSCELINÆ.

Genus LAMENIA Stål.

- 265.
- L. vulgaris**
- Fitch.

Greensburg. On trees and grass.

Subfamily DICTYOPHORINÆ.

Genus SCOLOPS Schaum.

- 266.
- S. sulcipes**
- Say.

Jeannette, July, 1902, on wild morning-glory (*Convolvulus*).
Patton, in a meadow.

Subfamily CIXIINÆ.

Genus OTIOCERUS Kirby.

- 267.
- O. coqueberti**
- Kirby.

Greensburg, July 10, 1900. Nicktown, August. On beech.

- 268.
- O. degeeri**
- Kirby.

Greensburg, July and August. On oak.

- 269.
- O. wolffi**
- Kirby.

Greensburg, September 3, 1902. One specimen was taken on oak.

Genus ANOTIA Kirby.

- 270.
- A. kirkaldyi**
- Ball.

Greensburg, September 1, 1900. One specimen was secured in a cloverfield.

Genus AMALOPOTA VanDuzee.

- 271.
- A. fitchi**
- VanDuzee.

Nicktown, August, 1900. On beech.

Genus CIXIUS Latreille.

- 272.
- C. colæpius**
- Fitch.

Greensburg, July and August; Pittsburgh. On hickory and weeds.

- 273.
- C. pini**
- Fitch.

Patton, June 19, 1903. On pines.

274. **C. albicinctus** Germar.

One specimen was taken with the preceding species at the same time.

275. **C. stigmatus** Say.

Greensburg.

Genus MYNDUS Stål.

276. **M. impunctatus** Fitch.

Greensburg, August 25, 1901; Patton, June 19.

Genus OLIARUS Stål.

277. **O. humilis** Say.

Greensburg, one typical specimen.

278. **O. complectus** Ball.

Greensburg, July 12; Patton, July 15. On high weeds.

Subfamily DELPHACINÆ.

Genus STENOCRANUS Fieber.

279. **S. dorsalis** Fitch.

Greensburg, July 20, 1900, October 22, 1902. In swampy places and along creeks in deep grass.

Genus KELISIA Fieber.

280. **K. axialis** VanDuzee.

Greensburg, September 2, October 22, 1901. In low meadows, often with *S. dorsalis*.

Genus PISSONOTUS VanDuzee.

281. **P. pallipes** VanDuzee.

Patton, June 19, 1903; Greensburg, September, 1900, at the edge of a dam in Oakford Park. Found also at Jeannette.

282. **P. brunneus** VanDuzee.

Found from July to September in company with the preceding species and in the same localities.

283. **P. marginatus** VanDuzee.

September. Taken in proximity to the other species enumerated.

Genus PHYLLODINUS VanDuzee.

284. **P. nervatus** VanDuzee.

Greensburg, July 3, 1901. In tall grass.

285. **P. flabellatus** Ball.

Greensburg, September 25. By close sweeping of low weeds on a dry hillside at the edge of a wood I succeeded in capturing both forms.

Genus *STOBERA* Stål.

286. **S. tricarinata** Say.

Allegheny City, Butcher's Run, October 27, 1899; Greensburg, September and October. Sweeping grass in meadows.

Genus *LIBURNIA* Stål.

287. **L. ornata** Say.

Greensburg, October 20. Feeds on grass.

288. **L. puella** VanDuzee.

Greensburg, October 22, 1902. A grass feeder.

Family CERCOPIDÆ. (SPITTLE-INSECTS OR FROG-HOPPERS.)

Subfamily *APHROPHORINÆ*.

Genus *LEPYRONIA* Amyot et Serville.

289. **L. quadrangularis** Say.

Greensburg, May 7 to June 7, 1903. A lighter-colored form occurred from August 5 to October 22. On hazels, maples, and small bushes.

Genus *APHROPHORA* Germar.

290. **A. quadrinotata** Say.

Erie, Patton, Greensburg, Pittsburgh, May. Occurs again from July to September. On small trees and weeds in neglected fields.

291. **A. parallela** Say.

Erie, July and August (*Henry Klages*). Patton, July 22, 1904. On pines.

Genus *CLASTOPTERA* Germar.

292. **C. protea** Fitch, var. **flava** Ball.

Greensburg, July 19, 1902, four specimens were obtained while sweeping weeds in a shaded spot. Patton, July 22, 1904, one specimen.

293. **C. xanthocephala** Germar.

Greensburg, October 2, 1900. One specimen.

294. **C. obtusa** Say, var. **achatina** Germar.
Greensburg and Patton. The insect lives on hickory, maple, hazels, and other trees.

Superfamily Jassoidea. (THE LEAF-HOPPERS.)

Family BYTHOSCOPIDÆ.

Genus BYTHOSCOPUS Germar.

295. **B. variabilis** Fitch.
Greensburg, July 1, 1901. One specimen. It is reported to occur on birch and black spruce.
296. **B. fenestratus** Fitch.
Greensburg. One specimen only was captured. It is reported as found from June to August on birch, black walnut, butternut and hickory.
297. **B. nigrinasi** Fitch.
Portage, August 2, 1900; Patton, July 15, 1902. It is said to be found on beeches and the hop-hornbeam.
298. **B. distinctus** VanDuzee.
Greensburg, Penn Station. July and August. On black walnut.

Genus PEDIOPSIS Burmeister.

299. **P. tristis** VanDuzee.
Patton, July 22, 1904. On wild plum bushes.
300. **P. trimaculatus** Fitch.
Found in company with the preceding species at the same time and place, and on the same plant.
301. **P. bifasciata** VanDuzee.
Patton, June 19, 1903, on willow. It is reported to occur on cottonwood.
302. **P. suturalis** Osborn and Ball.
Patton, June 19, 1903, on willow.
303. **P. basalis** VanDuzee.
Patton, June 19, 1903, on willows. Reported also as found on cottonwood.
304. **P. viridis** Fitch.
Patton, Greensburg, June to August. On the narrow-leaved willow (*Salix longifolia*).

305. *P. gleditschiæ* Osborn and Ball.

Patton, July 19, 1903. On willows. Reported to occur on the honey-locust.

306. *P. reversalis* Osborn and Ball.

Greensburg, July 5. On the narrow-leaved willow.

Genus IDIOCERUS Lewis.

307. *I. maculipennis* Fitch.

Greensburg, August to September; Portage, August. On hawthorn and crab-apple.

308. *I. provancheri* VanDuzee.

Portage, Greensburg, Pittsburgh. July to the middle of August. On hawthorn.

309. *I. cratægi* VanDuzee.

Portage; Greensburg, August 15. On hawthorn.

310. *I. alternatus* Fitch.

Greensburg, on willows.

311. *I. duzei* Provancher.

Patton, June 1903; Greensburg, August. On willows. It is also said to be found on poplars.

313. *I. lachrymalis* Fitch.

Penn Station, August 8, 1904. On poplars.

313. *I. nervatus* VanDuzee.

Greensburg, June. On willows.

Genus AGALLIA Curtis.

314. *A. quadripunctata* Provancher.

Patton, June. Reported as occurring on various plants in shady and moist places.

315. *A. constricta* VanDuzee.

Greensburg; Patton, July 15. Taken in fields and on lawns, often associated with the preceding species.

316. *A. novella* Say.

Patton, Greensburg, June and July; Butchers Run, Allegheny City, October 28. Often found with the preceding species.

317. *A. sanguinolenta* Provancher.

Patton, Greensburg, May, July and August. In pasture-fields on grass.

Family TETTIGONIDÆ.

Subfamily TETTIGONIINÆ.

Genus AULACIZES Amyot et Serville.

318. **A. irrorata** Fabricius.

Beatty, Greensburg, September and October. Beaten from grape-vines, small trees, and weeds.

Genus ONCOMETOPIA Stål.

319. **O. undata** Fabricius.

Charleroi.

Genus TETTIGONIA Geoffrey.

320. **T. gothica** Signoret.

Greensburg, August to October. On blueberries in woods.

321. **T. bifida** Say.

Beatty, Penn Station, Greensburg, July 23 to September 3, 1902. On blue-grass at the edge of woods.

322. **T. tripunctata** Fitch.

Greensburg, July to September. It occurs with the preceding species. It is also reported as found on the dogwood (*Cornus florida*).

323. **T. harti** Ball.

Greensburg, September. Found in a sunny pasture-field. This is the first record of the occurrence of this insect so far north.

Genus HELOCHARA Fitch.

324. **H. communis** Fitch.

Greensburg, Penn Station, March 17, May, July, October. On grass in deep places.

Genus DIEDROCEPHALA Spinola.

325. **D. coccinea** Forster.

Greensburg, May to July, a second brood appearing toward the end of August and living through September; Pittsburgh. The insect is found on grass and weeds, and may also be obtained by sweeping the undergrowth in woody places.

Genus *DRÆCULACEPHALA* Ball.326. *D. mollipes* Say.

Greensburg, May 12 to July 3; the second brood occurring from August to November; Pittsburgh. Taken by sweeping the grasses in meadows.

327. *D. novæboracensis* Fitch.

Patton, July 19, 1903, in a meadow; July 22, 1904, abundant in the woods in low moist places, while *D. mollipes* occurred in the meadows just as abundantly.

Genus *EUACANTHUS* Lepellétier et Serville.328. *E. acuminatus* Fabricius (*orbitalis* Fitch.).

Patton, June 19, 1903; Greensburg, May 25 to July 30. On weeds and also in woody places.

Subfamily *GYPONINÆ*.Genus *XEROPHLEA* Germar.329. *X. viridis* Fabricius.

Greensburg. A two-brooded species, taken from May 16 to October 22 in blue-grass, especially where sheep-sorrel occurs in open woods.

Genus *GYPONA* Germar.330. *G. octolineata* Say.

Greensburg; Allegheny, September 15, 1899, at light. Pittsburgh.

331. *G. flavilineata* Fitch.

Jeannette, Greensburg, August and September. On weeds and young trees.

332. *G. pectoralis* Spangberg.

Greensburg, May 25 to July 3, 1901; Pittsburgh. Swept from weeds near woods.

333. *G. rugosa* Spangberg.

Greensburg, August 8, 1901. One specimen was taken at this time on a wild grape-vine clambering upon an oak. Penn Station, August 4, 1904, on oak.

Genus *PENTHIMIA* Germar.334. *P. americana* Fitch.

Pittsburgh, June.

Family JASSIDÆ.

Subfamily ACOCEPHALINÆ.

Genus ACOCEPHALUS Germar.

335. **A. albifrons** Linnaeus.

Greensburg, September 5, 1901, in the cemetery on the roots of blue-grass; Penn Station, August 12, 1904, in woods under matted grass.

Genus XESTOCEPHALUS VanDuzee.

336. **X. pulicarius** VanDuzee.

Greensburg, June 18, August to October 28, 1899. On high ground in an open wood.

337. **X. tessellatus** VanDuzee.

Greensburg, May 25, at the same place as the preceding.

Subfamily JASSINÆ.

Tribe Dorydaria.

Genus PARABOLOCRATUS Fieber.

338. **P. viridis** Uhler.

Patton, taken with nymphs, June 19, 1903, on willows.

Genus PARAMESUS Fieber.

339. **P. twiningi** Uhler.

Penn Station, June 4, in numbers; September 14, 1903. On weeds, blackberry bushes and underbrush of various kinds.

340. **P. vitellinus** Fitch.

Greensburg, June 23, 1901; Penn Station, July 4, 1904. Sweeping bushes.

Tribe Deltocephalaria.

Genus PLATYMETOPIUS Burmeister.

341. **P. acutus** Say.

Greensburg, May 16 to June. A second brood appears from August to October. On grass, especially in open woods.

342. **P. frontalis** VanDuzee.

Greensburg, Patton. This species is also double-brooded, and often occurs in the company of *P. acutus* in shaded places.

Genus DELTOCEPHALUS Burmeister.

343. **D. sayi** Fitch.

Patton, Greensburg. The first brood is encountered in June, the second from August to October. The insect is found on blue-grass in woody pastures.

344. **D. debilis** Uhler.

Greensburg, June and July, in woodland.

345. **D. melsheimeri** Fitch.

Greensburg, May 25. In pastures.

346. **D. sylvestris** Osborn and Ball.

Greensburg. The first brood appears in June and July, the second in September and October. The insect is found on blue-grass in woodlands.

347. **D. inimicus** Say.

Patton, Greensburg. The first brood is found in May and June, the second in September and October. The species is abundant in pasture-fields.

348. **D. weedi** VanDuzee.

Greensburg. Occasionally taken with *D. sayi*.

349. **D. flavicostus** Stål.

Greensburg, July 1 to October 30, on blue-grass and weeds at the edge of woods.

350. **D. nigrifrons** Forbes.

Greensburg, June 2, the fall brood appearing in September and October. On blue-grass.

351. **D. apicatus** Osborn.

Greensburg, May 25; then again July 19 to September 21. On weeds in the woods.

Genus GONIOGNATHUS Fieber.

352. **G. palmeri** VanDuzee.

Greensburg, May 17; again July 3 to September 2, 1901. On blue-grass and weeds in open woods.

Tribe Athysanaria.

Genus ATHYSANUS Burmeister.

353. **A. exitiosus** Uhler.

Greensburg, October 22, 1900.

354. **A. striolus** Fallen.
Greensburg, June and July, in the woods of Huff Park.
355. **A. (Conosanus) extrusus** VanDuzee.
Greensburg.
356. **A. (Conosanus) plutonius** Uhler.
Greensburg, June 18 to August 25. Sweeping weeds in open woods.
357. **A. (Conosanus) vaccinii** VanDuzee.
Greensburg, June 18.
358. **A. (Stirellus) curtisi** Fitch.
Patton, Greensburg. The insect occurs in July and later on blue-grass. It is reported to be double-brooded.

Genus EUTETIX VanDuzee.

359. **E. johnsoni** VanDuzee.
Greensburg, August 25.
360. **E. seminuda** Say.
Greensburg, May 25 to June 19; again from August 15 to October 30. On hawthorn and weeds in woods.
361. **E. strobi** Fitch.
Greensburg, October 22, 1900.
362. **E. cincta** Osborn and Ball.
Greensburg, August and September. This and the preceding species are not common. They occur on blue-grass and weeds in open woods.

Genus PHLEPSIUS Fieber.

363. **P. irroratus** Say.
Greensburg. A very common species from June to October in meadows and weedy pastures. It is a nuisance at lamp-light.
364. **P. truncatus** VanDuzee.
Portage, August 2.
365. **P. incisus** VanDuzee.
Greensburg, August and September.
366. **P. fulvidorsum** Fitch.
Greensburg. It occurs in September with *irroratus* in dry places in woods on weeds and blue-grass.
367. **P. humidus** VanDuzee.
Beatty, Greensburg, August and September in humid situations.

368. **P. decorus** Osborn and Ball.

Greensburg, September 25, 1901. One specimen was found upon a log lying in tall grass. This is the first record of the occurrence of this species so far east. It was originally described from Nebraska and Iowa.

369. **P. majestus** Osborn and Ball.

Greensburg, September. Captured by close sweeping of very low weeds. This is the largest of the eastern species of *Phlepsius*.

Genus SCAPHOIDEUS Uhler.

370. **S. auronitens** Provancher.

Jeannette, Beatty. August to October in shaded places.

371. **S. jucundus** Uhler.

Patton, July 22, 1904; Jeannette, August 4, 1904, on oak in Oakford Park.

372. **S. consors?** Uhler.

Greensburg, August and September.

373. **S. lobatus** VanDuzee.

Patton, September 25, 1902.

374. **S. ochraceus** Osborn.

Beatty. One specimen.

375. **S. productus** Osborn.

Greensburg, July 2.

376. **S. intricatus** Uhler.

Jeannette, August 14. On Service-berry (*Amelanchier*).
Now in Osborn's Collection.

377. **S. luteolus** VanDuzee.

Greensburg.

378. **S. immistus** Say.

Greensburg, August; Pittsburgh. In damp field on bushes.

379. **S. melanotus** Osborn.

Greensburg, September 25. One female specimen.

Genus THAMNOTETRIX Zetterstedt.

380. **T. clitellaria** Say.

Patton, Greensburg, May and July; and again in September to the end of October; Pittsburgh. On grass and shrubs.

381. **T. oburata** VanDuzee.

Patton, September 25, 1902. One specimen.

382. **T. kennicotti** Uhler.

Greensburg, May 25 ; September 9 to October 30. Reported as found on oak and young hickory trees.

383. **T. melanogaster** Provancher.

Patton, June ; Greensburg, October 20.

384. **T. fitchi** VanDuzee.

Patton, Greensburg, July 15 ; September to October. Sweeping meadows.

385. **T. longula** Gillette and Baker.

Greensburg, November 27, 1899.

Genus **CHLOROTETTIX** VanDuzee.386. **C. unicolor** Fitch.

Patton, Greensburg, June and July. On willows.

387. **C. tergata** Fitch.

Greensburg, July. In damp woods.

388. **C. galbanata** VanDuzee.

Butchers Run, Allegheny, October 28, 1899 ; Greensburg, July to September. On grass and willows.

389. **C. lusoria** Osborn and Ball.

Patton, Greensburg, May 25, September. Taken by beating willows, also on grass.

Tribe **Jassaria**.Genus **JASSUS** Fabricius.390. **J. olitorius** Say.

Greensburg, Patton, August and September ; Penn Station, July 25 to August 10, 1904. On beech, hickory, and black walnut.

Tribe **Cicadularia**.Genus **GNATHODUS** Fieber.391. **G. punctatus** Thunberg.

Greensburg, March 17 to May 17 ; the fall brood from August to October. Taken by sweeping grass in damp places.

392. **G. impictus** VanDuzee.

Greensburg, May and June ; again in August to October 30. Found on blue-grass. It is also recorded as occurring on strawberry vines, wheat, and rye.

Genus *CICADULA* Zetterstedt.

- 393.
- C. sexnotata**
- Fallén.

Greensburg, May to August, October. A very common insect on young trees.

- 394.
- C. variata**
- Fallén.

Greensburg, August 28. In a dense wood along the creek.

- 395.
- C. punctifrons**
- var.
- americana**
- VanDuzee.

Erie, Patton, July and August. On willows.

- 396.
- C. divisa**
- Uhler.

Greensburg, October 2, 1902.

Subfamily *TYPHLOCYBINÆ*.Genus *ALEBRA* Fieber.

- 397.
- A. albostriella**
- Fallén.

Greensburg, July to October. Always on oak. It is reported as having been taken on ferns, rank weeds, pear, and cherry.

Genus *DICRANEURA* Hardy.

- 398.
- D. abnormis**
- Walsh.

Greensburg, May 17. Taken while sweeping grass.

- 399.
- D. fieberi**
- Löw.

Greensburg, June to September. On grass and small bushes.

Genus *EMPOASCA* Walsh.

- 400.
- E. smaragdula**
- Fallén.

Patton, July ; Greensburg, August, October. Usually on trees.

- 401.
- E. splendida**
- Gillette.

Greensburg.

- 402.
- E. obtusa**
- Walsh.

Greensburg, May to July, October. Common on the leaves of trees, bushes, and weeds.

- 403.
- E. pergandi**
- Gillette.

Greensburg, October 30.

- 404.
- E. mali**
- Le Baron.

The apple leaf-hopper is quite common in western Pennsylvania. It is reported elsewhere as occurring on the apple, currants, gooseberry-bushes, beans, potatoes, plum-trees, and wild grape-vines.

Genus EUPTERYX Curtis.

405. *E. vanduzei* Gillette.

I took this and the following species upon the same fern-stock at Patton, September 25, 1902.

406. *E. flavoscuta* Gillette.

Patton; Greensburg, October 30.

Genus TYPHLOCYBA Germar.

407. *T. tunicarubra* Gillette.

Greensburg, July 22, 1901. One specimen on oak. One specimen was also obtained at Jeannette under an electric light.

408. *T. tricineta* Fitch.

Butchers Run, Allegheny, October 27; Jeannette, Greensburg, July and later. Found on wild and cultivated grape-vines.

409. *T. harti* Gillette.

Greensburg, October 22, 1902. On mosses and oak.

410. *T. trifasciata* Say.

Greensburg, October 22. In moss.

411. *T. obliqua* Say.

Greensburg, June to October. It occurs on wild grape-vines, Virginia creeper, and grasses. It is reported in other localities as found on the oak and on apple-trees.

Vars. *dorsalis*, *novus*, and *fumida* Gillette occur at Greensburg from September to October.

412. *T. comes* Say.

Butchers Run, Allegheny, October 27; Greensburg, from the time in early spring when the first leaves appear upon the grape until after the grape leaves fall. Very abundant.

Vars. *zigzag* Walsh, *basilaris* Say, *vitis* Harris, *octonotata* Walsh, all are found here from July to October on grape-vines. The varieties *maculata*, *rubra*, and *infusata* Gillette are also found here.

413. *T. vulnerata* Fitch.

Occurs at Penn Station during the whole season on grape-vines and inflicts extensive injuries upon the plants. It is a bad insect.

Var. *niger* Gillette. Greensburg, October 22. On grape-vines.

414. **T. querci** var. **bifasciata** Gillette.

Greensburg, June, on linden ; July to September on oak.

415. **T. rosæ** Linnæus.

The species occurs everywhere on roses. It is also reported to be found on the apple, on currants, and grape-vines.

416. **T. lethierryi** Edwards.

Greensburg, July and August ; Allegheny, October.

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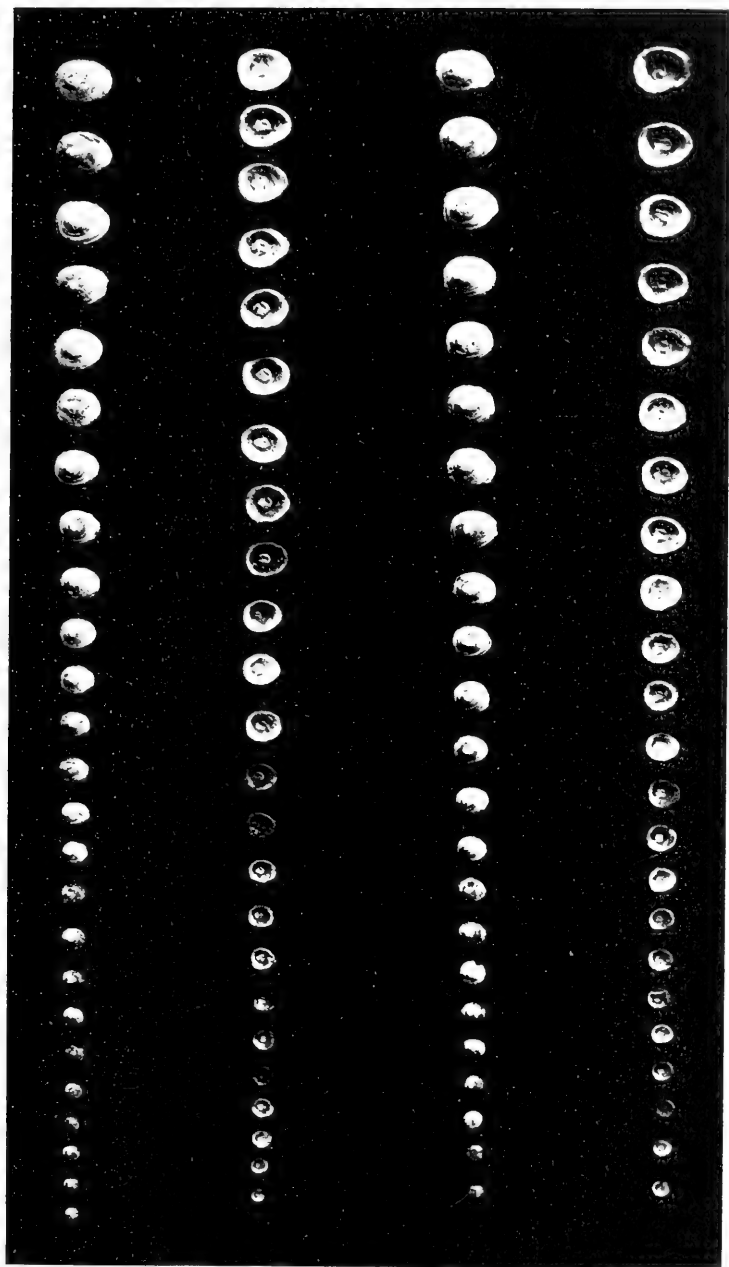
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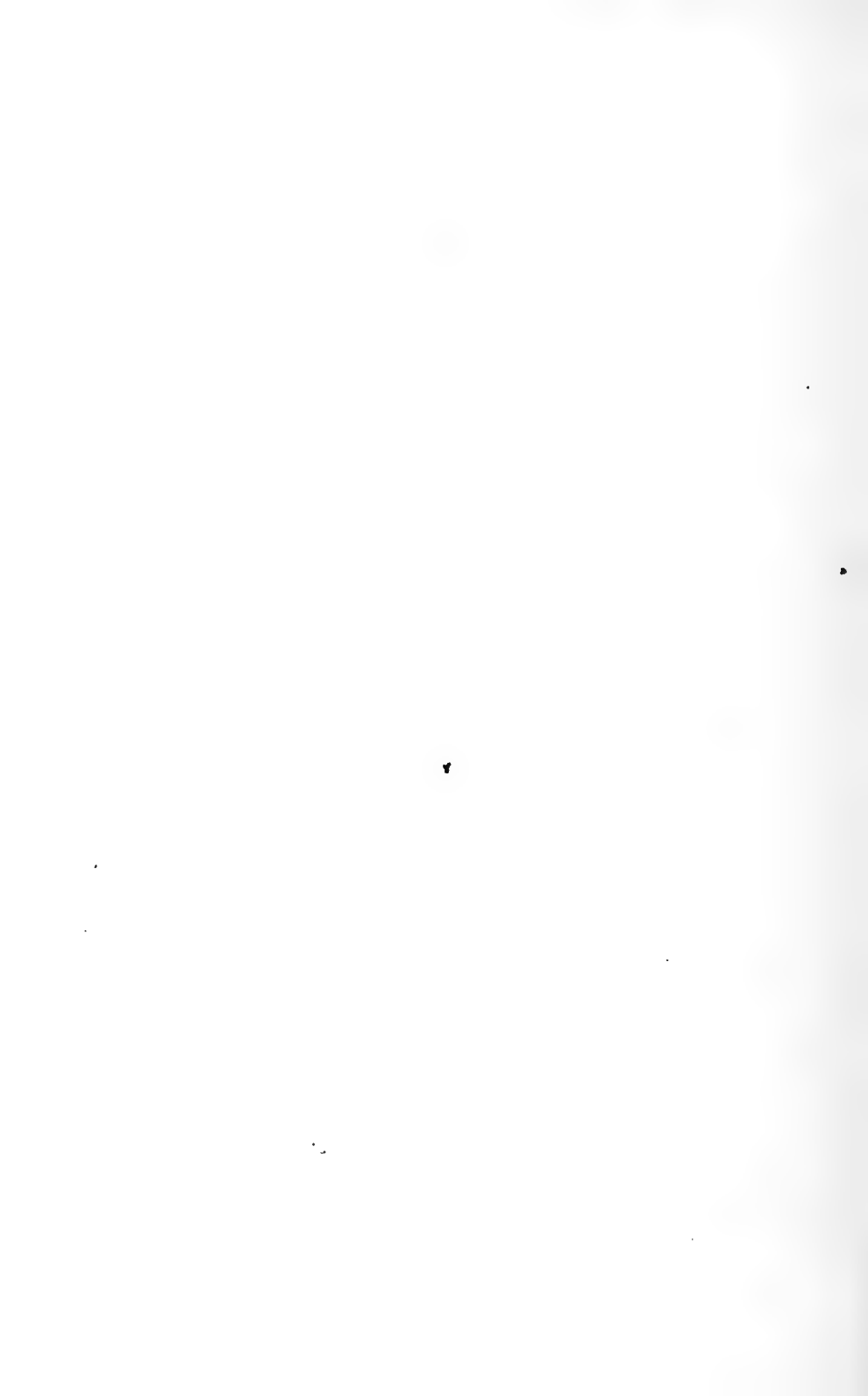
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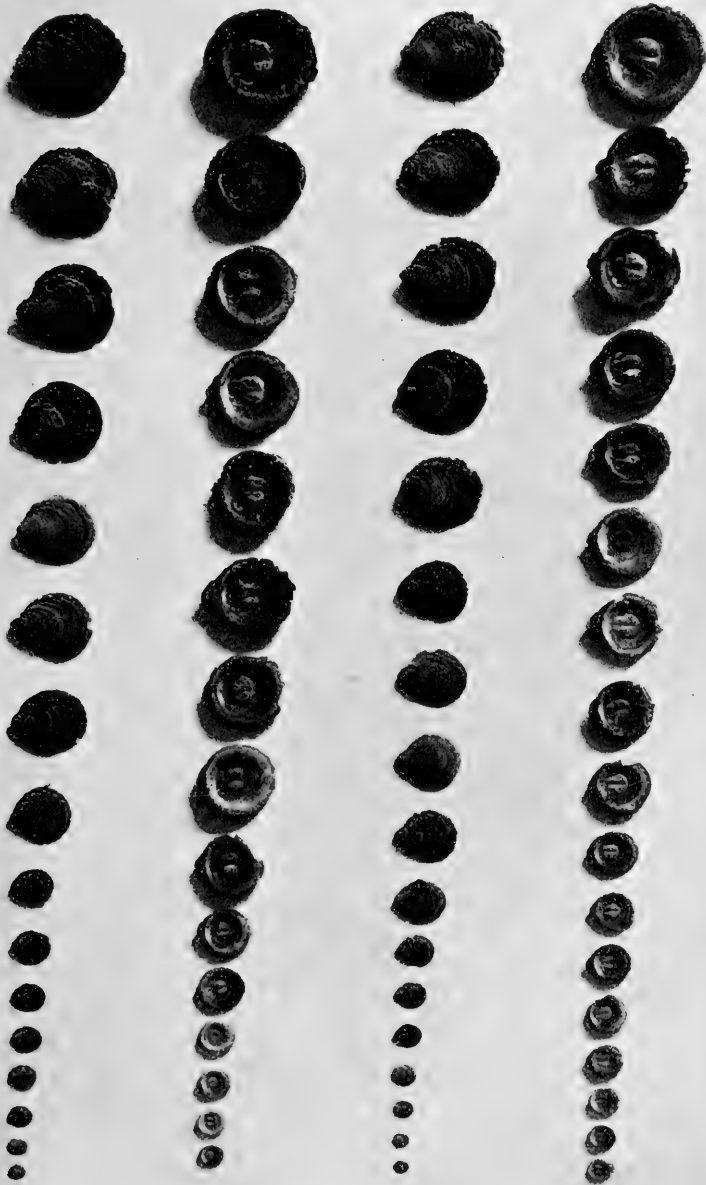
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Prüfung in der Fachprüfung für die Ausbildung zum Fachlehrer für die Fächer Mathematik und Physik





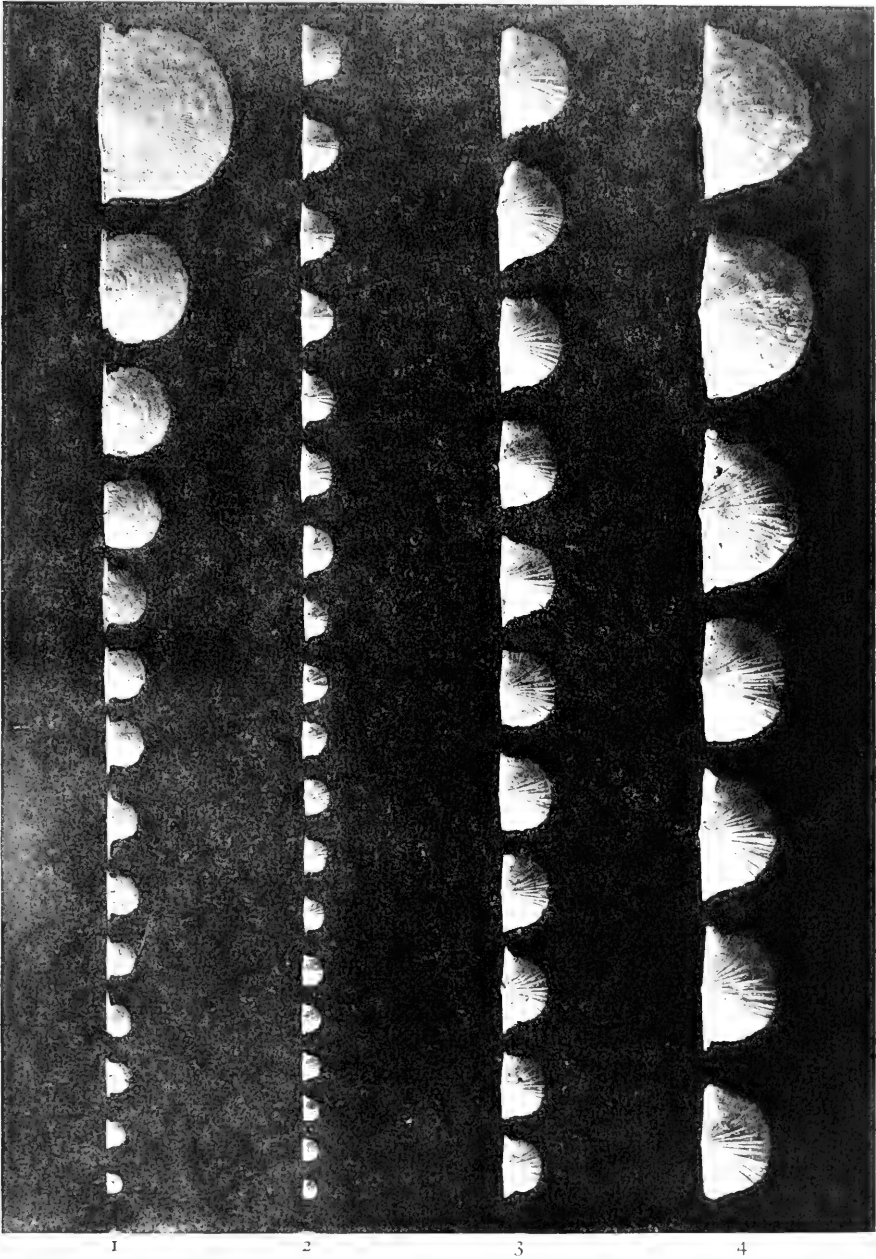
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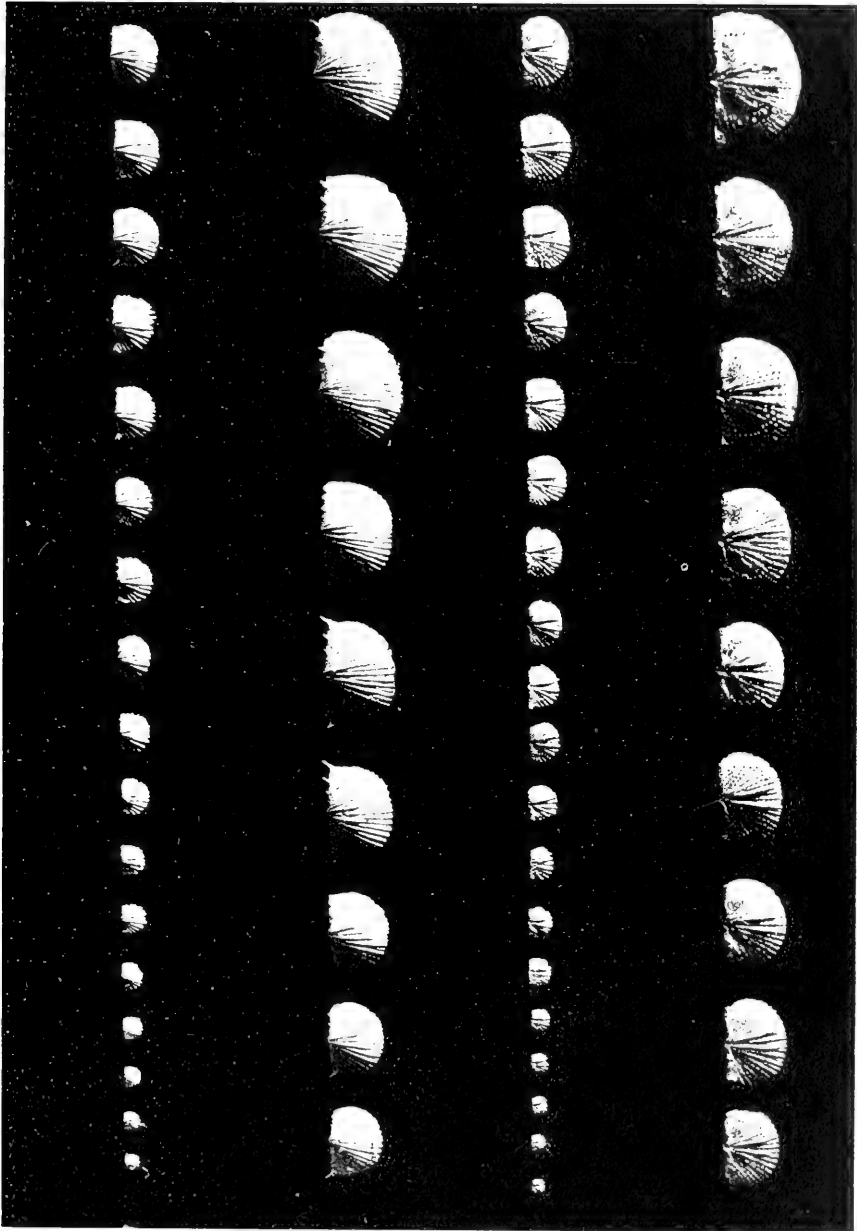
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4

Pholidops oblata Hall. $\times 2$.



1. — *Stropheodonta perplana* Conrad. 2-4. — *Stropheodonta inaequistrata* Conrad.



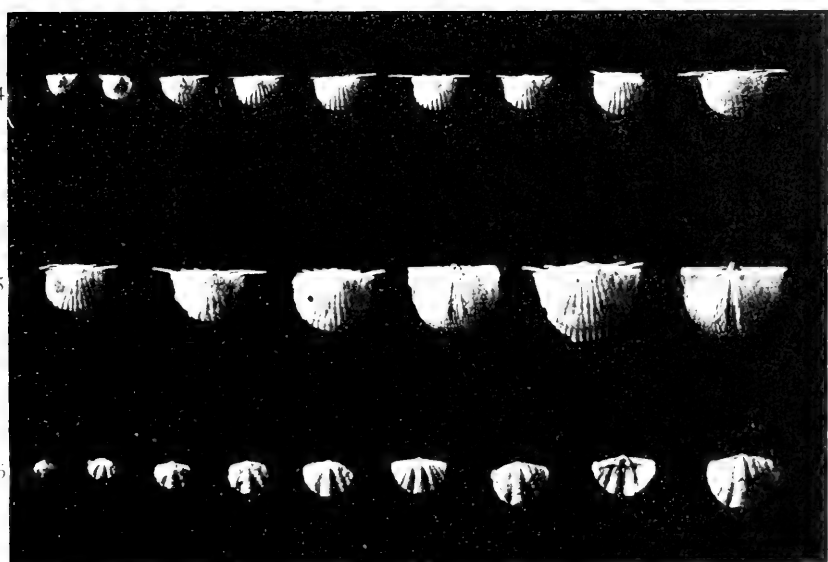
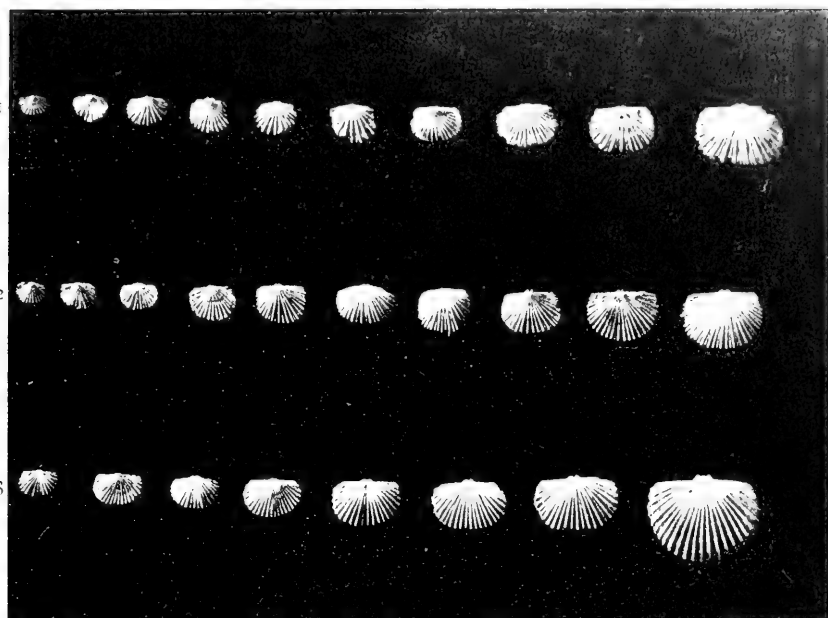
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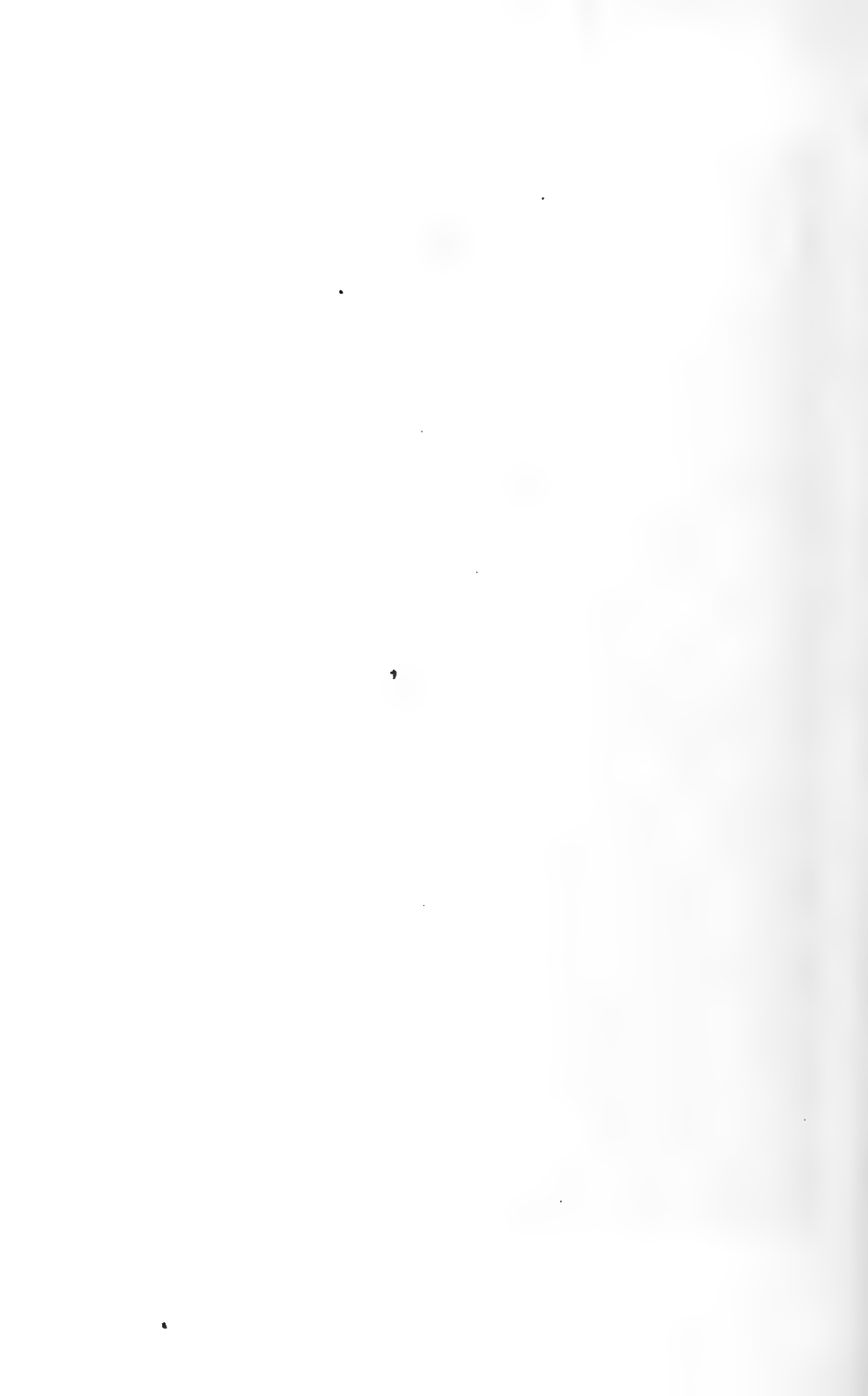
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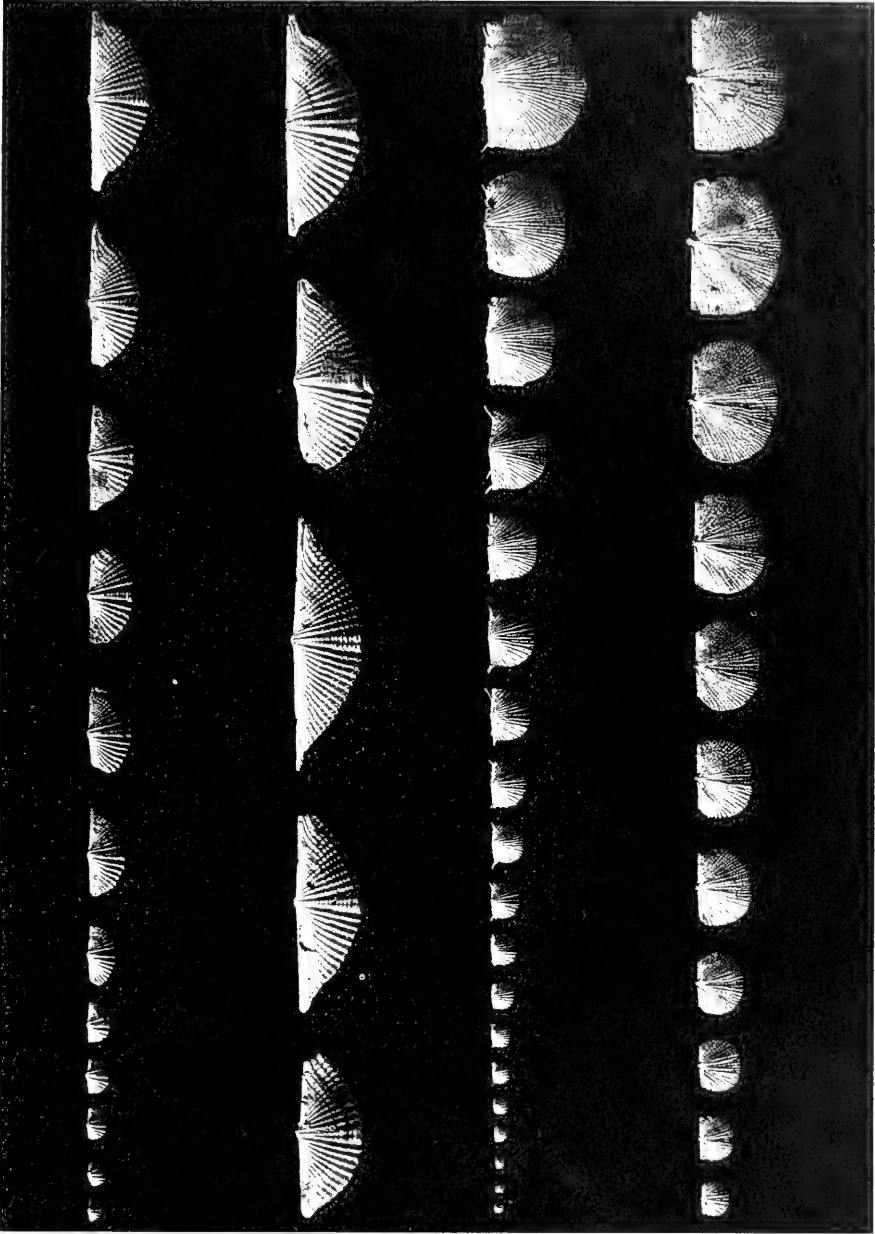
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Conchites socialis Ha.

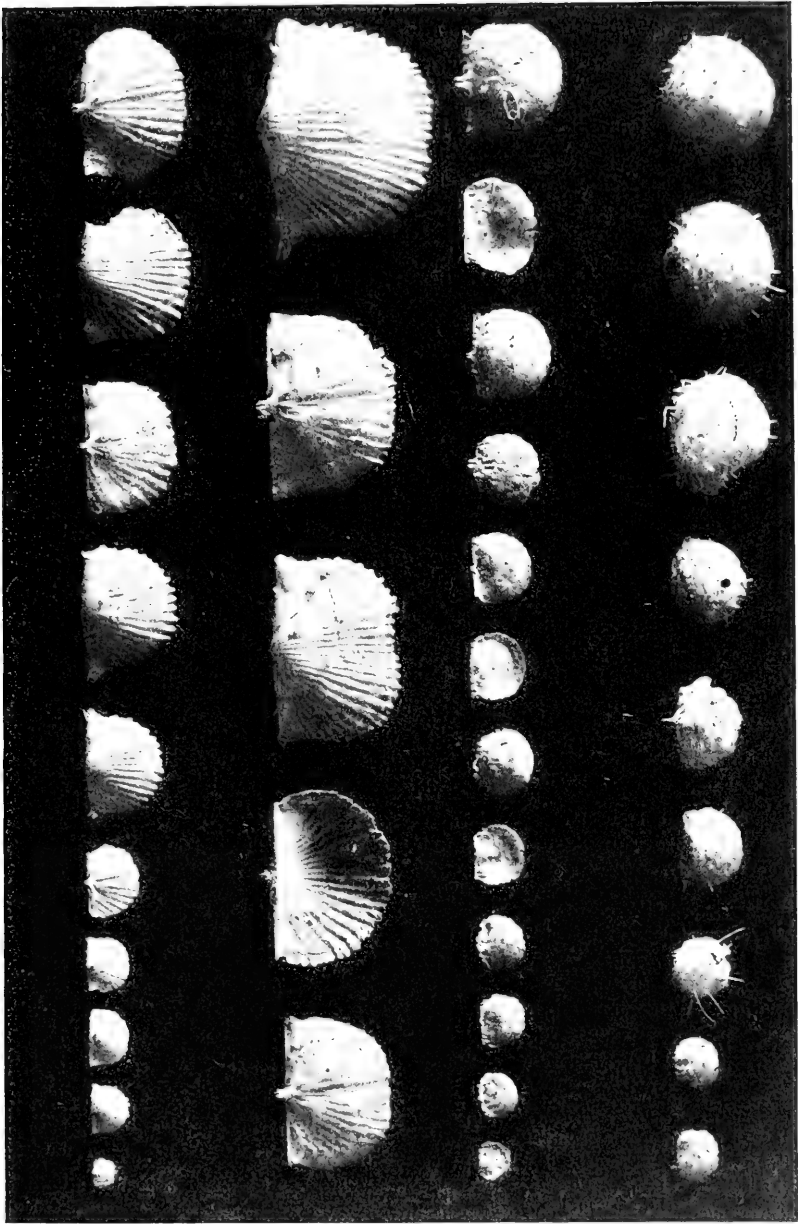


— *Orthothetes cnemungensis* var. *pectenacea* Hall. (1) 2. — *Orthothetes cnemungensis* var. *arctistriatus* Hall. (2) 3. — *Orthothetes bellulus* Clarke. (3) 2. 4. 5. — *Chonetes mucronatus* Hall. (4) 2. 6. — *Cyrtina hamiltonensis* Hall. (5) 2.





1 — *Spirifer multiradiatus* Conrad 2, 4 — *Chonetes coronatus* Conrad



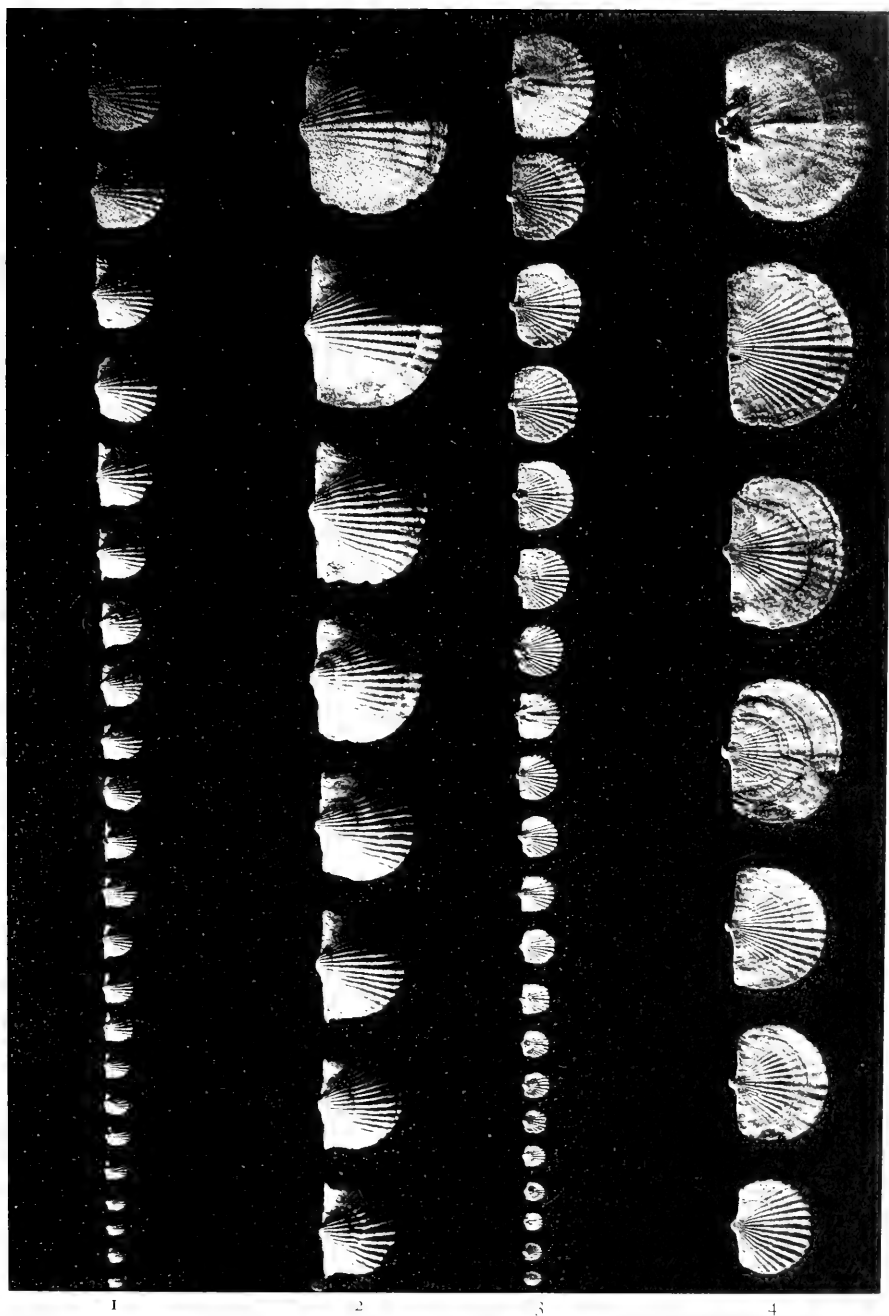
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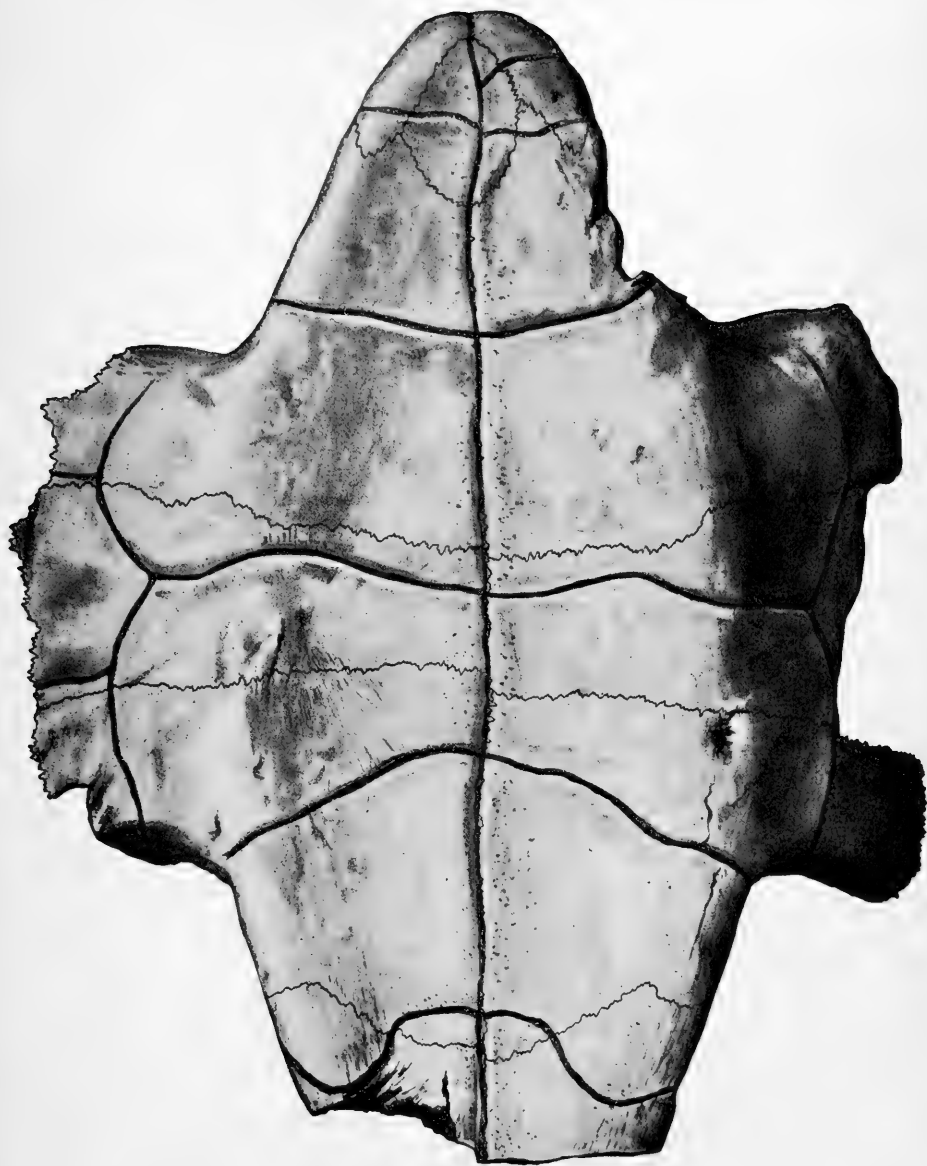
3

4

1 — *Cyrtoceras*, 2 — *Rhynchotrema*, 3 — *Strophomena*, 4 — *Strophomena*



Tropidoleptus narratus Conrad



Plastron of *Baëna callosa* Hay. $\frac{67}{100}$ natural size.



ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME III. NO. 2.

EDITORIAL.

THE celebration of Founder's Day at the Carnegie Institute on November 3 will be remembered for many years to come as having been one of the most notable of these celebrations which have taken place. The presence of the Rt. Hon. John Morley, M. P., added luster to the occasion, and his address not only held the interest of his hearers from beginning to end, but elicited their continuous applause. It was in every way worthy of his reputation as a thinker and friend of humanity. He endeared himself to the hearts of all who met him and who heard him.

THE library of the Museum has acquired the collections of books and pamphlets relating to paleontology which were the property of the late Professor J. B. Hatcher and of the late Professor C. E. Beecher of Yale University. The possession of these two libraries will enable students of paleontology in the Museum to work to greater advantage than possibly would be the case without access to the literature which they contain.

MR. W. H. UTTERBACK returned to the Museum about the middle of October. After many disappointing experiences in the difficult fields which had been assigned to him for exploration he at last succeeded in making some very valuable discoveries. He brought back with him to the Museum two splendid skulls of *Triceratops* which are among the largest and best preserved skulls in existence. In addition to this

material he brought back with him a great quantity of other material illustrating the fauna of the Laramie beds.

INTEREST in the Prize Essay Contest is at its height as these lines go to press. Two thousand pupils in the schools have applied for the necessary blanks and envelopes with which to make return of their essays to the Board of Judges. This is a much larger number than have ever applied for this material at any previous competition and gives promise that there will be a much larger number of essays presented than at any former time in the history of the Museum.

DURING recent months the Museum has been visited by a great many distinguished scientific men. One of our most welcome visitors was Mr. Arthur Smith Woodward, the Keeper of the Department of Geology at the British Museum, who was accompanied by Mrs. Woodward. The Chilean Commissioner to the World's Fair at St. Louis spent a day in studying the contents of the Museum, having been specially commissioned by his Government to make a study of the museums of the United States. Professor Allorge of the Department of Geology at the Sorbonne in Paris, the Marquis Eduardo Bosco of Rome, and a multitude of other gentlemen of distinction and well known attainments have been visitors from abroad, and a constant stream of able and distinguished scientific men representing the various colleges, universities, and museums of the United States has come and gone. Had anyone predicted twenty-five, or even ten years ago, that Pittsburgh would become to any extent a Mecca for scientific men, the Pittsburgher of that day would have laughed him to scorn. But, *tempora mutantur*.

MR KARL HARTMAN of Austin, Texas, has kindly communicated to the Editor a series of very interesting observations upon *Epipyrops barberiana* Dyar, the larva of which singular little moth he finds parasitic upon living specimens of the common Fulgorid, *Ormenis pruinosa* Say. A series of very interesting specimens has been kindly presented by Mr. Hartman to the Museum. The first record of the occurrence of a parasitic moth living upon the waxy secretions of a candle-fly was made in the *Proceedings* of the Entomological Society of London, in the year 1876, by Professor J. O. Westwood of Oxford. Mr. Dyar in 1902 described *Epipyrops barberiana* from rather scanty material.

It is barely possible that this insect has a higher northern range than has yet been determined, as *Ormenis pruinosus* is found abundantly all over the United States, and is very common in Pennsylvania. Students of the Homoptera would do well to keep their eyes open in order to ascertain whether or not the parasite is found in the valley of the Ohio.

THE restoration of the skeleton of *Diplodocus carnegii*, which is to be set up in the British Museum, has been completed and the boxes have been shipped to London. The erection of the reproduction will take place in the spring.

WITH obliging kindness His Highness the Prince of Monaco has presented to the library of the Museum a complete set of the publications of the Oceanographic Museum which he has established, embodying the highly interesting and valuable results of the deep sea explorations which he has been carrying on at great personal expense.

THE life of the members of the scientific staff of the Institute is at present lived under circumstances, which, were not the future gilded with the light of the brightest hopes and anticipations, would be, to say the least, trying. It is impossible to work well and to have rebuilding operations carried on at the same time and in the same place. The situation reminds us at intervals of the resolution introduced by a Hibernian member of the Board of County Commissioners, who made the following motion: "*Resolved*, that we build a new bridge across Sandy Creek. *Resolved*, that the new bridge be constructed out of the materials of the old bridge. *Resolved*, that the old bridge be left standing until the new bridge is completed." But all is certain to end well, and the Editor simply counsels the exercise of faith, hope, and charity.

THE first article in the present issue contains the last of the papers relating to the courts established in the district of West Augusta by the Commonwealth of Virginia. The publication of these old records which have been buried out of sight for over a hundred years and the existence of which was only known to a few persons, has been welcomed by students of local history with a great deal of approval and copies of the ANNALS containing them have been applied for from all over the land.

IN the new building which is in process of construction one of the spacious rooms is set apart as a place in which to gather historic relics, and the Editor trusts that this apartment will become to the student of local history in western Pennsylvania what the Museum of the Pennsylvania Historical Society in Philadelphia is to the student of local history in the eastern half of the Commonwealth. In this connection it is pleasant to notice that the Western Pennsylvania Historical Society seems to be again bestirring itself after a long sleep.

V. THE RECORDS OF DEEDS FOR THE DISTRICT OF
WEST AUGUSTA, VIRGINIA, FOR THE COURT
HELD AT FORT DUNMORE (PITTSBURGH, PA.),
1775-1776; COPIED CONSECUTIVELY AS RECORDED.

EDITED BY BOYD CRUMRINE, OF WASHINGTON, PA.

INTRODUCTION.

The following pages present a literal transcript of the original manuscript volume, in paste-board covers, in which were recorded by John Madison, the Clerk of the Court held for the District of West Augusta at Fort Dunmore, in 1775 and 1776, the contracts, deeds, and mortgages, proved, or acknowledged, before said Court and ordered to be recorded.

The record of the first deed recorded was "examined" and the deed delivered to Bernard Gratz, the grantee thereof, on May 28, 1775. Towards the end of the book, however, are found copied a number of instruments relating to real estate, the records of which are not shown to have been "examined" and attested by the Clerk. Why this was is not known.

No similar book, containing the records of deeds, etc., proved or acknowledged before the Court for Yohogania County, has been found. When that Court was organized and held its first day's session, to wit, on December 23, 1776, Virginia as well as Pennsylvania had become an independent State in the newly-formed United States of America; and one of the matters of business done on that day was to choose and appoint unanimously Dorsey Pentecost as the Clerk of Court, and to demand "the Records and Papers from John Madison, Junior, Deputy Clerk of East Augusta, in whose custody they are, which he peremptorily refused, notwithstanding he confessed he had seen an act of assembly directing him so to do," and to order "that a Process be issued to apprehend the said John Madison, and forthwith bring him before the Court to answer the above misdemeanor" (See Vol. II. of these ANNALS, pp. 79, 81).

This John Madison, Jr., was the son and deputy of John Madison, who had been appointed Clerk of the County Court of Augusta County when that court was first organized at Staunton, Va., to wit, on December 9, 1745, (Peyton's History of Augusta County, p. 32), and he had been sworn in as Deputy Clerk at the last term of the Court held at Fort Dunmore, to wit, on August 20, 1776, the next session being held at Augusta Town (now Washington, Pa.), on September 17, 1776, (Vol. I. of these ANNALS, p. 565). John Madison, the Clerk, was a cousin of the father of James Madison, who became President of the United States, and was the father of Rev. James Madison, long the distinguished head of William and Mary College, and the first Bishop of the Protestant Episcopal Church of Virginia. (Peyton's History of Augusta County, p. 345).

INDIAN TITLES.

To make the transcripts of the conveyances by George Croghan and others contained in the records following more intelligible, as well as to throw light upon entries made of transactions before the Court for the District of West Augusta, copies are presented of two old Indian conveyances made at the great Treaty with the Six Nations held at Fort Stanwix, now Rome, Oneida County, New York.

The French and Indian War had terminated in 1763, resulting in the ending of the French Occupation of the Monongahela and Ohio Valleys. The same year had occurred and ended Pontiac's Conspiracy, and a general peace with the Indians followed until Dunmore's War in 1774, the pioneers being disturbed only by sporadic Indian raids and depredations. The Indians, however, still claimed the lands upon the waters of the Monongahela, Allegheny, and Ohio Rivers as their own. These Indians, called by the French the Iroquois, formed a confederacy, named by the English "the Six Nations," composed of the Mohawks, Oneidas, Senecas, Onondagas, Cayugas, and Tuscaroras, and had their Council House, or seat of government, in the valleys of western New York. It was chiefly to establish certain boundaries limiting their exclusive rights on the East, that the Treaty at Fort Stanwix had been brought about.

The congress was opened on October 24, 1768. There were present Sir William Johnson, Baronet, his Majesty's Superintendent of Indian Affairs; William Franklin, Esq., Governor of New Jersey; Frederick Smith, Chief Justice of New Jersey; Thomas Walker,

Esq., Commissioner for the Colony of Virginia ; Richard Peters and James Tilghman, Esqrs., for the Provincial Council of Pennsylvania ; George Croghan, Daniel Claus, and Guy Johnson, Esqrs., Deputy Indian Agents, as well as many others of the whites, attracted by interest or curiosity ; and on November 5, 1768, after full conference and extended discussion, at least three grants by the Six Nations already executed were delivered ; one to Thomas Penn and Richard Penn, the proprietaries of Pennsylvania ; one to William Trent, in trust for the Indian Traders whose goods had been carried off by the Indians from Logstown (below Pittsburgh) in 1763, and one to George Croghan, for himself absolutely.

By the cession to the proprietaries of Pennsylvania, the Six Nations granted a large tract of country lying within the general boundary of Pennsylvania and contained within the following limits, to wit :

“Beginning in the said Boundary Line, on the East side of the East Branch of the River Susquehanna, at a place called Owegy, and running with the said Boundary Line down the said Branch on the East side thereof, till it comes opposite the mouth of a Creek called by the Indians Awandae, and across the River and up the said Creek on the South side thereof, and along the Range of Hills called Burnett’s Hills by the English, and by the Indians ———, on the north side of them, to the head of a Creek which runs into the West Branch of Susquehanna, which Creek is by the Indians called Tiadaghton, and down the said Creek on the south side thereof, to the said West Branch of Susquehanna ; then, crossing the said River and running up the same on the south side thereof, the several Courses thereof, to the Fork of the same River, which lies nearest to a place on the River Ohio [Allegheny] called Kittanning, and from the said Fork, by a strait line to Kittanning aforesaid, and then down the said River Ohio [Allegheny], by the several Courses thereof, to where the western Bounds of the said Province of Pennsylvania crosses the same River ; and then, with the said Western Bounds to the South Boundary thereof ; and with the south Boundary aforesaid, to the East side of the Allegheny Hills, and with the same Hills, on the East side of them, to the West Line of a Tract of Land purchased by the said Proprietaries from the Six Nation Indians, and confirmed by their Deed bearing date the twenty-third Day of October, one thousand seven hundred and fifty-eight ; and then with the Northern Bounds of that Tract to the River Susquehanna, and crossing the River Susque-

hanna, to the Northern Boundary line of another Tract of Land purchased from the Indians by Deed bearing Date the twenty-second Day of August, one thousand seven hundred and forty-nine; and then, with that Northern Boundary Line to the River Delaware, at the North Side of the mouth of a Creek called Lechawacsein; then up the said River Delaware, on the West Side thereof, to the Intersection of it by an East Line, to be drawn from Owegy aforesaid, to the said River Delaware; and then, with that East Line to the Beginning, at Owegy aforesaid."

The grant from which this quotation is made seems to have been dated November 5, 1768: See I Olden Time, p. 401; also, IX Col. Records, p. 554. But two other grants had already been executed, the first being that to William Trent, in trust for the Indian traders, dated November 3, 1768, here given in full, our copy having been made from the duplicate original parchment deed now or lately hanging in the State House at Philadelphia.

THE SIX NATIONS TO WILLIAM TRENT, IN TRUST.

TO ALL PEOPLE To whom these Presents shall come, Greeting: Know ye That We, Abraham, a Mohawk Chief; Sennghois, a Oneida Chief; Saguarisera, a Tuscarora Chief; Chenaugheata, Chief of the Onondaga Council; Tagaia a Cayuga Chief, & Gaustarax a Seneca Chief; Chiefs and Sachems of the Six United Nations, and being and effectually representing all the Tribes of the Six United Nations, send Greeting:

WHEREAS, Robert Callender, David Franks, Joseph Simon, Levy Andrew Levy, Philip Boyle, John Baynton, Samuel Wharton, George Morgan, Joseph Spear, Thomas Smallman, Samuel Wharton, Administrator of John Welch, deceased, Edmund Moran, Evan Shelby, Samuel Postlethwait, John Gibson, Richard Winston, Dennis Crohon, William Thompson, Abraham Mitchel, James Dundas, Thomas Dundas, and John Ormsby, in and by their several and respective letters or Powers of Attorney duly signed, sealed, and delivered by them and now produced, interpreted and explained to us, have constituted, nominated and appointed William Trent, of the County of Cumberland and Province of Pennsylvania, Merchant, their lawful Attorney and Agent to ask, Sollicit, demand and receive from the Sachems, Councillors, and Warriors of the said Six United Nations, a Grant of a Tract of Land as a Compensation, Satisfaction, or Retribution for

the Goods Merchandise and Effects of the said William Trent and the Traders aforesaid, Which the Shawanese, Delaware and Huron Tribes, Tributaries of the said Six Nations, (Contrary to all good faith, and in Violation of their repeated Promises of Safety and Protection to their Persons, Servants and Effects whilst Trading in their Country), did, in the Spring of the year one thousand seven hundred and sixty three, Violently seize Upon and unjustly appropriate to their own Use ;

AND WHEREAS, we are now convened in full Council by Order of our Father the King of Great Britain, France and Ireland, Defender of the Faith, &c., at Fort Stanwix, in the province of New York, in order to agree for, ascertain and finally fix and settle a permanent and lasting Boundary Line between the Hunting Country which we, at the Conference aforesaid, shall and will reserve for ourselves, our Children and our Tributaries, and the Territories of the said King of Great Britain.

AND WHEREAS application was formerly made to the Six United Nations by Sir William Johnson, Baronet, at the Requisition of the aforesaid Traders who had sustained and suffered the losses aforesaid, for a Retribution for the same, which the Six United Nations promised and agreed to, whensoever He the said Sir William Johnson, Baronet, should be empowered by his said majesty, the King of Great Britain, to establish the Boundary Line aforesaid ;

AND WHEREAS, the said Sir William Johnson, Baronet, has now at this present Congress reminded the said Six United Nations of their said Promise, and at the earnest desire of aforesaid Traders, by their Attorney, Strongly recommended to the Six United Nations to make them a Restitution by a Grant of a Tract of Land to his said Majesty the King of Great Britain, his Heirs and Successors, to and for the Only Use Benefit and Behoof of the said William Trent, in his own Right and as Attorney as aforesaid :

ALL WHICH the said Six United Nations, having taken into their Consideration and being heartily disposed to agree thereunto as an Instance of their Justice and Concern in the said losses, do therefore, by these Presents, signify publish and declare that notwithstanding the Grant and Gift hereby made and given by them Unto his said Majesty the King of Great Britain, and So forth, To and for the Only use Benefit and Behoof of the said William Trent, in his own Right and as Attorney as aforesaid, will be included within the Ces-

sion, Sale and Boundary Line which the said Six United Nations shall and will make, sell and grant to the said King of Great Britain, at the Conference aforesaid, holden at Fort Stanwix aforesaid, by the said Sir William Johnson, Baronet, yet nevertheless the said Six United Nations have neither asked, demanded, nor received from Him the said Sir William Johnson, Baronet, nor from any other Person or Persons in Behalf of the said King of Great Britain, any Consideration for the hereby given and granted Premises, neither shall nor will the said Six United Nations, nor their Heirs nor Descendants, (and by these presents They the Six United Nations wholly and intirely interdict and prohibit them from so doing), demand nor receive from the said King of Great Britain, nor from his Successors, nor from his or their Ministers or Servants, any Consideration whatsoever or howsoever for the hereby granted, bargained or now given premises, or any part, purpart, or parcel thereof, the same being their own Voluntary Act and Deed Solely and bona fide designed and intended by Them as a Compensation, Satisfaction and Retribution for the Losses sustained by the said William Trent and the Indian Traders aforesaid by the Depredations of the Shawnesse, Delaware and Huron Tribes of Indians aforesaid In the aforesaid Year one thousand seven hundred and sixty three :

NOW THIS INDENTURE WITNESSETH That we the said Abraham, Sennghois, Saguarisera, Chenaugheata, Tagaia, and Gausstarax (Chiefs and Sachems of the said Six United Nations, and being and effectually as aforesaid representing all the Tribes of the said Six United Nations), for and in the consideration of the Sum of Eighty Five Thousand Nine Hundred and Sixteen Pounds, Ten Shillings and Eight Pence, lawfull Money of the Province of New York, (the same being the amount of the Goods and Merchandise which were unjustly seized and taken as aforesaid by the Shawnesse, Delaware and Huron Tribes of Indians aforesaid, from the said William Trent, Robert Callender, David Franks, Joseph Simon, Levy Andrew Levy, Philip Boyle, John Baynton, Samuel Wharton, George Morgan, Joseph Spear, Thomas Smallman, Samuel Wharton, Administrator of John Welch, deceased, Edmund Moran, Evan Shelby, Samuel Postlethwait, John Gibson, Richard Winston, Dennis Crohon, William Thompson, Abraham Mitchel, James Dundas, Thomas Dundas, and John Ormsby, in the aforesaid year one thousand seven hundred and sixty three, Whereof just and fair Accounts have on Oath anp

Affirmation been produced, interpreted and explained to Us and which at our Desire are now lodged and deposited with the said Sir William Johnson Baronet ; And for and in Consideration of the Sum of Five Shillings, lawfull Money aforesaid, to Us in hand paid by the said William Trent, the Receipt whereof We do hereby acknowledge, Do give, grant, bargain and Sell Unto his said Majesty, his Heirs and Successors, to and for the only use Benefit and Behoof of the said William Trent, in his own right and as Attorney aforesaid :

All that Tract or parcel of Land BEGINNING At the Southerly side of the Mouth of little Kanawha Creek, where it empties itself into the River Ohio, and Running from thence South East to the Laurel Hill ; Thence along the Laurel Hill until it strikes the river Monongahela ; Thence down the Stream of the said River Monongahela, according to the several Courses Thereof, To the Southern Boundary Line of the province of Pennsylvania ; Thence Westerly along the Course of the said Province Boundary Line as far as the same shall extend, and from Thence by the same Course to the River Ohio ; Thence down the said River Ohio according to the several Courses thereof to the place of Beginning,

TOGETHER with all and Singular the Trees, Woods, under-Woods, Mines, Minerals, Oars, Waters, Water-Courses, Fishings, Fowlings, Huntings, Profits, Commodities, Advantages, Rights, Liberties, Passages, Hereditaments, and Appurtenances, whatsoever, to the said Tract or Parcel of Land belonging or in any wise appertaining, or which now are or formerly have been accepted, reputed, taken, known, and Occupied, or enjoyed, to or with the same or as part, parcel or Member Thereof ; and the Reversion and Reversions, Remainder and Remainders, Rents, Issues, and Profits of all and singular the said premises above mentioned and every part and parcel thereof, with The Appurtenances ; and also all the Estate, Right, Title, Interest, property, claim and demand, whatsoever, whether Native, legal or equitable, of Us the said Indians and Each and Every of Us and of all and every other person and persons whatsoever of or belonging to the said Nations, of, in, to and out of all and singular the Premises above mentioned and of, in, to, and out of Every part and parcell thereof, with the appurtenances,

TO HAVE AND TO HOLD all and singular the said Tract, Parcel and parcells of Land, given, granted and bargained Premises, with their Appurtenances, Unto his said Majesty King George the

Third, his Heirs and Successors, but to and for the Only use Benefit and Behoof of the said William Trent, in his own Right and as Attorney aforesaid, his Heirs and assigns, forever ;

AND the said Abraham, Senngghois, Saguarisera, Chenaugheata, Tagaia, and Gaustarax, for themselves and for the said Six United Nations and all and Every Other Nation and Nations, Tribes, Tributaries, and Descendants of the said Six United Nations, and their and Every of their posteritys, the said Tract and Parcell of Land and Premises and Every Part thereof, against them the said Abraham, Senngghois, Saguarisera, Chenaugheata, Tagaia, and Gaustarax, And against the said Six United Nations and their Tributaries and Descendants, and all and Every of their posteritys, to his said Majesty, his Heirs and Successors, but to and for the Only Use Benefit and behoof of the said William Trent, in his own Right and as Attorney aforesaid, his Heirs and Assigns, Shall and will Warrant and forever defend by these Presents.

IN WITNESS Whereof, we, the said Chiefs and Sachems, in behalf of Ourselves respectively and in behalf of the whole Six United Nations aforesaid, have hereunto set Our hands and seals, In the presence of the persons Subscribing as Witnesses hereunto, at the Congress held at Fort Stanwix aforesaid, this the Third day of November, in the Ninth year of his Majesty's Reign, and In the Year of our Lord One thousand seven Hundred and Sixty Eight.

ABRAHAM, or TYCHAURISERA (Seal),
Chief of [Totem] the Mohawks.

WILLIAM, or SENNGHOIS (Seal),
Chief of [Totem] the Oneidas.

HENDRICK, or SAGUARISERA (Seal),
Chief of [Totem] the Tascaroras.

BUNT, or CHENAUGHEATA (Seal),
Chief of [Totem] the Oonondagas.

TAGAIA (Seal),
Chief of [Totem] the Cayugas,

GAUSTERAX (Seal),
Chief of [Totem] the Senecas.

Sealed and delivered in the presence of us — The letters (d n and the words to said) being first interlined ; the words Senngghois, Saguarisera, Chenaugheata wrote in a Razure.

WM. FRANKLIN,
Governor of New Jersey.

FRE. SMYTH,
Chief Justice of New Jersey.
 THOMAS WALKER,
Commissioner for Virginia.
 RICHARD PETERS and JAMES TILGHMAN,
Of the Council of Pennsylvania.
 JOHN SKINNER,
Captain of the 70th Regt.
 JOSEPH CHEW,
of Connecticut.
 JOHN WITHERHEAD,
of New York.
 JOHN WALKER,
of Virginia.
 E. FITCH,
of Connecticut.
 THOMAS WALKER, Jun.,
of Virginia.
 JOHN BUTLER,
Interpreter for the Crown.

Recorded in the office for recording of Deeds for the City and County of Philadelphia, in Book J., vol. 5, page 243, etc.

Certified under my Hand & Seal of my Office aforesaid, This 12th day of January, 1769.

[Seal]

Will Parr, Recd.

[ON MARGIN.]

This is the Copy of the Grant mentioned in The annexed Affidavit of John Skinner, Esquire, SWORN before me this Day.

Dated the Third Day of February, One Thousand Seven Hundred and Seventy Six.

WILLIAM ATKINSON,
 MAYOR,
 of New Castle upon
 Tyne in the Kingdom
 of Great Britain.

William Trent, the grantee of the foregoing deed, was the Captain Wm. Trent, under whom Ensign Edward Ward, with his small force of men, was constructing the fort at the Forks of the Ohio, when, on April 17, 1754, he surrendered to the French and Indians, who com-

pleted the fort and called it Fort Duquesne. Subsequently Trent must have executed a sufficient conveyance to his beneficiaries for their interests in this grant, for at a session of the Court for the District of West Augusta held on April 17, 1776, there were proved and ordered to be recorded a "Deed of Lease and Release of Trust from William Trent," to the many persons named, and a "Deed of Partition from and between the same Persons," showing how very many individuals had by that time become interested in this celebrated grant: Vol. I of these ANNALS, page 562.

On November 4, 1768, the day after the above-mentioned grant to William Trent, in trust, and the day before the delivery of the cession to the proprietaries of Pennsylvania, there was made a grant to George Croghan, which is presented here because of the many grants made under it of lands lying on the south side of the Monongahela and Ohio, extending southward to the neighborhood of the present Bridgeville, or beyond, which grants are recorded in the records to be presented.

THE SIX NATIONS TO GEORGE CROGHAN.

TO ALL PEOPLE to whom these presents shall come, Greeting: Know ye, that we, Abraham, a Mohawk chief; Sennghois, an Oneida chief; Chenaugheata, an Onondaga chief; Tagaia, a Cayuga chief, and Gaustarax, a Seneca chief, chiefs and sachems of the Six United Nations, and being and effectually representing all the tribes of the Six United Nations, send greeting.

WHEREAS, Iohonerissa, Scaroyadia, Cosswentanica, chiefs or sachems of the Six United Nations, did, by their deed duly executed bearing date the 2nd day of August, 1749, for and in consideration of the following goods and merchandise being paid and delivered to them at a full council of the Six United Nations, Delawares and Shawanese, held at Logstown, on the river Ohio, on the 2nd of August, 1749, that is to say: 240 strouds, 400 Duffield blankets, 460 pairs of half thick stockings, 200 shirts, 20 pieces of calico, 20 pieces of callimancœ, 20 pieces of embossed serge, fifty pounds of vermilion, 50 gross of gartering, 50 pieces of ribbon, 50 dozen of knives, 500 pounds of gunpowder, 1000 of bar lead, 3000 gun flints, 50 pounds of brass kettles, 4 pounds of thread, 1000 needles, ten dozen jews-harps, 20 dozen tobacco tongs, and 100 pounds of tobacco: grant and sell unto George Croghan, of the Province of Pennsylvania, Esquire, in fee, a certain tract or parcel of land, situate, lying and

being on the southernly side of the river Monongehela : BEGINNING at the mouth of a run nearly opposite to Turtle Creek, and then down the river Monongehela to its junction with the river Ohio, computed to be ten miles ; then running down the eastern bank and sides of and unto the said river Ohio to where Raccoon creek empties itself into the said river ; thence up the said creek ten miles, and from thence on a straight or direct line to the place of beginning on the aforesaid river Monongehela, CONTAINING, by estimation, one hundred thousand acres of land, be the same more or less.

AND WHEREAS, the said Iohonerissa, Scaroyadia and Cosswentanica, chiefs or sachems, as aforesaid, for the consideration herein-after mentioned to them in full council, as aforesaid, paid and delivered, that is to say : 140 strouds, 240 Duffield blankets, 275 pair of half thick stockings, 120 shirts, 12 pieces of calico, 12 pieces of callimancœ, 12 pieces of embossed serge, 30 pounds of vermilion, 12 gross of gartering, 30 pieces of ribbon, 30 dozen knives, 300 pounds of gunpowder, 600 of bar lead, 1000 gun flints, 30 pounds of brass kettles, 4 pounds of thread, 500 needles, six dozen of jews-harps, six dozen tobacco tongs, and 50 pounds of tobacco : did, by one other deed bearing date the same day and year last aforesaid, grant, bargain and sell unto the said George Croghan, in fee, one other tract or parcel of land, situate, lying and being on the river Yoxhiogeni, including the Indian village called the Seurchly¹ old town ; the same tract or parcel of land containing 15 miles in length, on the said river, and ten miles in breadth, and including the lands on both sides of the said river Yoxhiogeni, which 15 miles in length and ten miles in breadth, he, the said George Croghan, has liberty to locate either upon or down the said Yoxhiogeni, but nevertheless in such manner so as to include and locate the said Indian village and land called the Seurchly¹ old town, which said tract or parcel of land contains, by estimation, 60,000 acres, be the same more or less.

AND WHEREAS, the said Iohonerissa, Scaroyadia and Cosswentanica did, by one other deed, bearing date the day and year last aforesaid, for the consideration herein mentioned to them in full council paid and delivered, as aforesaid, that is to say : 96 strouds, 160 Duffield blankets, 184 pair of half thick stockings, 80 shirts, 8 pieces of calico, 8 pieces of embossed serge, 20 pounds of vermilion, 20 gross of gartering, 20 pieces of ribbon, 20 dozen of knives, 200

¹ Perhaps Sewickley.

pounds of gunpowder, 400 of bar lead, 1000 gun flints, 20 pounds of brass kettle, 2 pounds of thread, 500 needles, 4 dozen jews-harps, 4 dozen tobacco tongs, 50 pounds of tobacco : Grant, bargain and sell unto the said George Croghan, in fee, one other tract or parcel of land, situate, lying and being, and BEGINNING on the east side of the river Ohio, to the northward of an old Indian village, called Shanopinstown, at the mouth of a run called the two mile run ; then up the said two mile run where it interlocks with the heads of the two mile spring, which empties into the river Monongahela ; then down the said two mile spring to the several courses thereof unto the sd. Monongehela ; then up the said river Monongehela to where Turtle Creek empties itself into the same river ; then up the said Turtle creek to the first forks thereof ; then up the north or northerly branch of the said creek to the head of the same ; thence a north or northerly course until it strikes Plum creek ; then down said Plum creek until it empties itself into the river Ohio, and then down the said river Ohio to the place of beginning, where, as aforesaid, the two mile run discharges itself into the said river Ohio ; CONTAINING by estimation 40,000 acres, be the same more or less,

Which said several grants, bargains and sales, [were] duly made and executed, by the last mentioned chiefs or sachems, in pursuance of certain powers and authorities delegated to and vested in them for the purpose aforesaid by the chiefs or sachems of the Onondaga Council, in full council assembled ;

AND, WHEREAS, the said first-mentioned chiefs or sachems of the Six United Nations, parties to these presents, are not only truly and sensible and convinced that the said George Croghan hath faithfully and justly paid and delivered unto Iohonerissa, Scaroyadia and Cosswentanica, chiefs or sachems as aforesaid, all and several the goods and merchandize herein particularly recited and mentioned, but of the great justice and integrity of the said George Croghan, used and reserved by him towards the said Six Nations and their allies in all his public and private conduct and transactions, wherein they have been concerned :

NOW, KNOW YE THEREFORE, that we, the said chiefs or sachems of the Six United Nations, in full council assembled at Fort Stanwix, for and in consideration of the sum of five shillings to them in hand paid by the said George Croghan, the receipt whereof they do hereby acknowledge, and for and in consideration of the aforesaid

goods and merchandize paid and delivered by him unto Iohonerissa, Scaroyadia, Cosswentanica, chiefs as aforesaid, have granted, bargained, sold and aliened, released, enfeoffed, ratified and fully confirmed, and by these presents do grant, bargain, sell, alien, release, enfeoffe, ratify and fully confirm unto his Most Sacred Majesty George III., King of Great Britain, France and Ireland, Defender of the Faith, &c., his heirs and successors, for the use, benefit and behoof of the said George Croghan, his heirs and assigns, all those the above described or mentioned tracts or parcels of land, granted or intended to be granted by the said several recited deeds as aforesaid, and also all mines, mineral ores, trees, woods, underwoods, waters and water courses, profits, commodities, advantages, rights, liberties, privileges, hereditaments and appurtenances whatsoever unto the said several tracts or parcels of land belonging or any way appertaining; and also the reversion and reversions, remainder and remainders, rents, issues and profits thereof, and of every part or parcel thereof, and all the estate, right, title, interest, use, property, possessions, claim and demand of them, the said Abraham, Sennghois, Saguarisera, Chenaugheata, Tagaia, Gaustarax, chiefs or sachems aforesaid, and of all and every other person and persons whatsoever, or belonging to said nations, of, in, to and out of the premises, and every part and parcel, thereof,

TO HAVE AND TO HOLD the said several tracts and parcels of land, and all and singular the said granted or bargained premises, with the appurtenances, unto his said Majesty, his heirs and successors, to and for the only use, benefit and behoof of the said George Croghan, his heirs and assigns forever;

AND the said Abraham, Sennghois, Saguarisera, Chenaugheata, Tagaia and Gaustarax for themselves and for the Six Nations, and all and every other nation and nations, tributaries and dependents on the said Six United Nations, and their and every of their posterity, the said several tracts of land and premises and every part thereof, against them, the said Abraham, Sennghois, Saguarisera, Chenaugheata, Tagaia and Gaustarax, and against the said Six United Nations, and their tributaries and dependents, and all and every of their posterity, unto his said Majesty, his heirs and successors, to and for the only use, benefit and behoof of the said George Croghan, his heirs and assigns, shall and will warrant and forever defend, by these presents;

PROVIDED, always, nevertheless, and it is the true intent and

meaning of these presents, and the said Abraham, Sennghois, Saguarisera, Chenaugheata, Tagaia and Gaustarax, do hereby covenant and agree to and with his said Majesty and his heirs and successors, to for the only use, benefit and behoof of the said George Croghan, his heirs and assigns, that if any or all of the said several tracts of land or any part thereof, shall hereafter be found to be within the bounds and limits of a certain grant bearing date the 4th of March, 1681, made by Charles II., King of Great Britain, &c., to William Penn, Esq., for the tract of country called and known by the name of Pennsylvania, that then and in such case, his said Majesty, his heirs and successors, to and for the only use, benefit and behoof of the said George Croghan, his heirs and assigns, shall be permitted and shall have and enjoy full right, power and authority to survey and locate the said several quantities of 100,000 acres, 60,000 and 40,000 acres of land, be the same more or less, as contained within the limits and bounds of the said several and respective tracts or parcels of land mentioned and described as aforesaid, in such quantities and in such parts and places of, in and within the cession or grant of land or territory, which shall be ceded and granted at the conference aforesaid, to the said King of Great Britain by the chiefs or sachems of the said Six United Nations, anything herein contained to the contrary thereof in any wise notwithstanding.

In witness whereof the said chiefs and sachems, in behalf of ourselves, respectively, and in behalf of the whole Six United Nations aforesaid, have hereunto set our hands and seals, in the presence of the persons subscribing as witnesses hereunto, at a Congress held at Fort Stanwix, aforesaid, this, the 4th day of November, in the year 9th of his Majesty's reign, and in the year of our Lord 1768.

ABRAHAM, or TYCHAUESERA,

a chief of the Mohawks.

WILLIAM, or SENNGHOIS,

a chief of the Oneidas.

HENDRICK, or SAGUARISERA,

a chief of the Tuscaroras.

BURT, or CHENAUGHEATA,

a chief of the Onondagas.

TAGAIA,

a chief of the Cayugas.

GAUSTERAX,

a chief of the Senecas.

The mark

[The Steel] (l. s.)
of his nation.

The mark

[The Stone] (l. s.)
of his nation.

The mark

[The Cross] (l. s.)
of his nation.

The mark

[The Mountain] (l. s.)
of his nation.

The mark

[The Pipe] (l. s.)
of his nation.

The mark

[The High Hill] (l. s.)
of his nation.

Sealed and delivered in the presence of us: The word "Croghan" being first written on Rasures eleven times, and the words "and, or down tract," being first interlined. Sealed and delivered in presence of us all, the foregoing interlineations, Rasures and writings on Rasures being first made.

WM. FRANKLIN, Governor of New Jersey.

FRE. SMYTH, Chief Justice of New Jersey.

THOMAS WALKER, Commissioner for Virginia.

RICHARD PETERS, }
JAMES TILGHMAN, } of the Council of Pennsylvania.

JOHN SKINNER, Capt. in the 70th Regiment.

JOSEPH CHEW, of Connecticut.

JOHN WEATHERHEAD, of N. Y.

JOHN WALKER, of Virginia.

E. FITCH, of Connecticut.

THOMAS WALKER, JUNIOR, Virginia.

JOHN BUTLER, Interpreter for the Crown.

The foregoing deed to George Croghan is copied here from Peyton's History of Augusta County, page 74. It was recorded in the Recorder's office at Philadelphia, and on September 23, 1775, it was offered for proof and record before the Court for the District of West Augusta held at Fort Dunmore on that date, but objection being made it was ordered to lie over for further proof. (See Vol. I of these ANNALS, page 554.)

It will be remembered that in 1768, the year of the treaty at Fort Stanwix when all these Indian grants were made, the boundary controversy between Pennsylvania and Virginia was not yet ended, and it was still unknown how far the province of Pennsylvania extended to the westward. Mason and Dixon, when extending the southern boundary line in 1767, had been stopped by the Indian chiefs composing their watchful escort, at the second crossing of Dunkard Creek, in the southern part of Greene County, at a point thirty six miles short of Pennsylvania's five degrees of longitude from the Delaware; "it was the will of the Six Nations that the survey should be stayed:" Latrobe's Address. But, when it was settled by the Baltimore Conference of 1779 that the southern boundary of Pennsylvania should be extended to its full length, and that from the southwest corner thus reached the western boundary should be a line drawn due north from

that corner, then it became known to a certainty that the grants to William Trent, in trust, and to George Croghan, had both become worthless as to lands within the boundaries of Pennsylvania.

The southwest corner and the western boundary of Pennsylvania were actually marked out on the ground in 1784-5; and Croghan's grant, which had been fruitlessly relied upon to protect the settlers upon George Washington's lands in what is now Mt. Pleasant Township, Washington County, Pennsylvania, became extinct; it is still in evidence, however, by marks upon trees occasionally confusing the surveyors of the present day. And by the beneficiaries under the deed to William Trent, in trust, there was formed the Indiana Company, which had quite an interesting history. Pushed out of Pennsylvania, as it eventually was, Lieutenant Thomas Hutchins, an engineer with Bouquet's expedition, made a survey of its lands in what is now West Virginia, about the southwestern corner of Pennsylvania. The company called its immense tract "Indiana," and pressed a recognition of its title successively before the Legislature of Virginia, the Congress of the United States, and the United States Supreme Court, and failed in all its efforts; so that for a hundred years that celebrated grant, also, has been a matter of ancient history only.

It is manifest, however, that at the time all these Indian grants were made it was believed that the western boundary of Pennsylvania would fall on a line parallel with the meanders of the Delaware River, and would eventually lie somewhere east of the Monongahela River at Pittsburgh.

TRANSCRIPT OF THE RECORD OF DEEDS.

| | | |
|------------------|--|---|
| (1) ¹ | EXAMINED AND DELIVERED Bernard Gratz, May 28, 1775. | This indenture made the tenth day of July in the year One Thousand Seven Hundred and seventy two Between George Croghan Esquire on the one part and Bernardus Gratz of the City of Philadelphia Merchant on the other part : Whereas Iohonorissa Scaraydia and Cosowantinecea, Cheifs or Sachems of the Six United Nations of Indians, did by their deed duly Executed Bearing date the Second day of August One Thousand Seven Hundred and forty nine for the Consideration therein Specified Grant Bargain and Sell unto the |
|------------------|--|---|

¹ The marginal figures represent the pages of the original record.

said George Corghan in Fee a Certain Tract or Parcel of Land Situate lying and being on the South side the Monongahela River Beginning at the Mouth of a Run nearly Opposite to Turtle Creek and then down the said Monongahela River to its Junction with the River Ohio Computed to be ten Miles, then Running down the Eastern bank or side of the said River Ohio to where Racoon Creek empties itself into the said River. Thence up the said Creek ten miles, and from thence on a direct line to the place of beginning; Containing by Estimation One hundred thousand Acres be the same more or less as by the said Deed may more fully appear; And Whereas certain chiefs or Sachems fully representing the Six united Nations aforesaid in full Council at Fort Stanwix Assembled did by their deed duly executed bearing date the fourth day of November One thousand seven hundred and sixty eight for the Consideration therein mentioned grant ratify and confirm unto his most Sacred Majesty George the third by the Grace of God King of Great Britain France and Ireland &c his heirs and successors for the Use benefit and behoof of the said George Croghan all the above bounded and described tract or parcel of Land and premises as by the said Deed Poll Recorded in the Office for recording of Deeds in the City and County of Philadelphia in Book J Volume the fifth Page the two hundred and thirty ninth &c may more fully and at large appear Now this Indenture Witnesseth that the said George Croghan for and in Consideration of the sum of Six hundred pounds lawful money of Great Britain to him the aforesaid George Croghan by Him the aforesaid Bernard Gratz in hand paid the receipt whereof the said George Croghan doth hereby acknowledge And by these Presents doth freely and absolutely grant bargain and sell alien release and confirm unto the said Bernard Gratz (in his actual possession now being by virtue of a Bargain and Sale thereof to him made for one whole year by Indenture bearing date the day next before the day of the date of these presents and by force of the Statute for transferring of Uses into possession) and to his heirs and Assigns for ever A Certain tract or parcell of Land being part of the aforesaid tract of Land situate lying and being on the West branch of Racoon Creek, Beginning at a White Oak tree marked on two

- sides with three Notches and a Blaze above them being the most South Westerly Corner of the aforesaid tract of Land granted by the United Nations of Indians as aforesaid North forty three Degrees and thirty Minutes East, three hundred Chains to a stone, thence South fifty-Six Degrees and twenty one minutes East three hundred and fifty Chains to a Stone Corner of Joseph Simons's Land, thence by the said Simons's Land South fifty Degrees and thirty minutes West three hundred and seventy two Chains and ninety links to a Stone Corner of said Simons's Land standing in the South West bounds of the aforesaid original tract of land thence along the Bounds of the said Original tract North forty four degrees and thirty minutes West to the place of beginning containing Ten thousand one hundred and twenty nine acres two Quarters and thirty Perches with the allowance of Six Acres Pr Cent for Roads &c— Together with all and singular the members Appurtenances and advantages thereunto belonging And all the Estate Right Title and Interest Claim and demand whatsoever or both at Law and in Equity of him the said George Croghan of in and to all and singular the said premises above mentoned and of in and to every part thereof with the Appurtenances To have and to hold the said tract of Land Heriditaments and premises above mentioned and every part thereof with the Appurtenances unto the said Bernard Gratz his heirs and Assigns to the only Use benefit and behoof of Him the said Bernard Gratz his heirs and Assigns forever Subject Nevertheless to the Quit Rents to grow and become due to his Majesty his heirs and successors & to no other Incumbrance whatsoever And further that the said George Croghan and his heirs and every other person and persons and his and their heirs anything having or claiming in the said premises above mentioned or any part thereof by from or under him them or any of them shall and will from time to time and at all times upon the reasonable Request and at the proper Costs and charges of him the said Bernard Gratz his heirs and Assigns make do and execute or cause to be made done and executed all and singular such other lawful and reasonable Act and Acts, Thing and things, Device and Devices Conveyance and Conveyances in the Law whatsoever for the further better and more perfect granting and con-
- (3)

veying of all and singular the said premises and every part thereof unto the said Bernard Gratz his heirs and Assigns to the only proper Use and Behoof of him the said Bernard Gratz his heirs and Assigns forever As by the said Bernard Gratz his heirs or assigns or his or their Council learned in the Law shall be reasonably advised devised and required

In Witness whereof the said George Croghan hath hereunto set his hand and affixed his seal the day and year first above written. — Geo. Croghan [L S] Signed Sealed & delivered in the presence of us, Joseph Simon Robt Lettis Hooper Junr.

Received the day of the date of the within written Indenture Six hundred pounds Sterling money of Great Britain being the full Consideration mentioned in this Deed.

Geo Croghan

Witness

Joseph Simon

Robt Lettis Hooper Junr.

Bedford ss

Personally appeared before me Alex^d. McKee one of his Majestys Justices of the peace for said County Joseph Simon and Robert Lettis Hooper Junr. subscribing Witnesses to this Instrument in writing and being duly sworn according to Law did say that they personally knew the said George Croghan and saw him sign seal and deliver this Instrument in writing and acknowledge it to be his Act and Deed and desired it might be recorded as such Witness my hand and Seal July the tenth one thousand seven hundred and seventy two

Alex. McKee [L S]

At a Court Continued and held for Augusta County at Fort Dunmore May 18th 1775.

- (4) George Croghan Gent acknowledged this his deed of Bargain and Sale with a receipt thereon Endorsed to Bernard Gratz Gent which is Ordered to be Recorded

Test JOHN MADISON Cl Cu

EXAMINED AND DELIVERED
Bernard Gratz, May 28, 1775.

This Indenture
made the Six-
teenth day of May

in the year of our Lord One Thousand seven Hundred and

seventy five Between George Croghan of Pittsburg Esquire of one part and Bernard Gratz of Philadelphia Merchant of the other part: Whereas Iohonorissa Scarayadya and Cosswantinicea Chiefs or Sachems of the six United Nations of Indians did by their deed duly Executed bearing date the Second day of August in the Year of our Lord One thousand seven hundred and forty nine for the Consideration therein specified grant bargain and sell unto the said George Croghan in fee a certain Tract or Parcel of Land situate lying and being on the South side the Monongahela River, beginning at the mouth of a Run nearly opposite Turtle Creek and then down the said Monongahela River to its Junction with the River Ohio computed to be ten miles then running down the Eastern Bank and sides of and unto the said River Ohio to where Racoon Creek empties itself into the said River thence up the said Creek ten miles and from thence on a Direct line to the place of beginning containing by Estimation One hundred thousand acres be the same more or less as by the said Deed may more fully appear.

— And Whereas certain Chiefs or Sachems fully representing the six united nations aforesaid in full Council at Fort Stanwix Assembled did by their Deed Poll duly executed bearing date the fourth day of November One thousand seven hundred and sixty eight for the Consideration therein mentioned Grant ratifie and confirm unto his most sacred Majesty George the third by the Grace of God King of Great Britain France and Ireland &c his heirs and successors for the Use benefit and behoof of the said George Croghan all the above bounded and described tract or parcel of Land and premises as by the said Deed Poll Recorded in the Office for recording of Deeds in the City and County of Philadelphia in Book J Volume the fifth page the two hundred and thirty ninth &c may more fully and at large appear Now This Indenture Witnesseth that the said George Croghan for and in Consideration of the sum of Two thousand One hundred and one pounds nineteen shillings lawful money of Great Britain to him the said George Croghan by him the aforesaid Bernard Gratz in hand paid the receipt whereof he the said George Croghan doth hereby acknowledge hath granted bargained sold aliened released and confirmed and by these presents doth fully freely and absolutely

grant bargain sell alien release and confirm unto the said Bernard Gratz and to his heirs and assigns for ever A certain Tract or parcel of Land being a part or parcel of the aforesaid described tract of Land situate lying and being on the Western side of Chartiers Creek beginning at a stake corner to James Innis and running thence with the said Innis's line S 83 E 68o Rod to a Stake on a line of Lot No 18 thence with the said line N 7 E 186 Rod to a Stake Corner to said Lot and to Lot No. 22 thence No 63 15 West 47 Rod to a Stake Corner to said Lott thence N 7 E 16o Rod to a white Oak Corner to said Lot, thence N 52 E 13o Rod to a Stake on a line of the said Lott Corner to Lot No 27 thence with a line of the said Lot N 46 45 W 157 Rod to a Stake corner to said Lot, thence N 52 3o East 347 Rod to a Stake Corner to said Lott and to Lot No 32 thence N 72 E 331 Rod to a stake on a line of Lot No 31 Corner to said Lot No 32 thence North 315 Rod to a Stake Corner to said Lot No 31 and the Lot No 41 thence N 47 W 36 Rod to a Stake Corner to said Lot N 41 thence N 4 W 224 Rod to a Stake Corner to said Lot No 41 thence N 86 E 126 1/2 Rod to a Stake corner to said Lot and to Lot No 42 thence N 27 East 101 3/4 Rod to a Stake Corner to said Lot No 42 and to Lot No 46 thence N 7 E 354 Rod to a Stake Corner to said Lot No 46 thence S 67 3o E 59 1/2 Rod to a Stake Corner to said Lot and to Lot No 55 thence N 17 E 186 Rod to a stake corner to said Lot No 55 and to Lot No 13 thence North 56 Rod to a White Oak on the Western bank of Chartiers Creek Corner to said Lot No 13 thence down the Western side of said Creek with the meanders thereof to a White Oak on the said Western Bank thereof Corner to said Lot thence with the line of the said Lot N 28 W 12o Rod to an Elm on the said Western Bank of the said Creek Corner to said Lot thence down the Western side of the said Creek with the meanders thereof to a hickory on the said Western Bank of the said Creek corner to John Mainard thence with the said Mainard Line S 84 W 28o Rod to a stake Corner to the said Mainard and to Lotts No 64 and 62 thence S 7 W 2o5 Rod to a Stake corner to said Lot No 62 thence N 83 W 3o4 Rod to a Stake corner to said Lot thence N 7 E 158 Rod to a stake Corner to said Lot and to Lots No 64 & 65 thence N 83 W

240 Rod to a stake Corner to said Lot No 65 thence with a line of said Lot N 7 E 116 Rod to a Stake on the said line Corner to Edward Ward, thence with the said Wards line N 63 45 W 247 Rod to a Stake on the said Line and thence S 7 W 2697 Rod to the place of beginning including the Lots No 19, 20, 21, 23, 24, 25, 26, 28, 29, 33, 34, 35, 36, 37, 38, 39, 40, 43, 44, 45, 47, 48, 49, 50, 51, 52, 53, 54, 56, 57, 58, 59, 60, 61, and 75 containing fourteen thousand and thirteen Acres with the Allowance of 6 Acres Pr Cent for Roads and highways with the Rights Members and appurtenances thereof and all houses Edifices, Buildings Orchards Gardens Lands Meadows Pastures feedings Commons Trees Woods under woods Way Paths Waters Watercourses Easements Profits Commodities Advantages Hereditaments and Appurtenances whatsoever unto the said tract of land belonging or in any wise appertaining also the reversion and Reversions Remainder and Remainders Rents and Services of all and Singular the said premises above mentioned and every part and parcel thereof with the Appurtenances And also all the Estate Right Title Interest Claim and demand whatsoever both at Law and in Equity of him the said George Croghan of in and to every Part and parcel thereof with the Appurtenances. To have and to hold the said tract of Land hereditaments and premises above mentioned and every part and parcel thereof with the appurtenances unto the said Bernard Gratz his heirs and Assigns to the only proper Use Benefit and Behoof of him the said Bernard Gratz his heirs and Assigns forever Subject nevertheless to the Quit Rents to grow and become due to his majesty his heirs and Successors and to no other Incumbrance whatsoever And farther that he the said George Croghan and his heirs and every other person and persons and his and their heirs any thing having or claiming in the said premises above mentioned or any part thereof by from or under him them or any of them shall and will from time to time and at all times hereafter upon the reasonable request and at the Cost and charges of the said Bernard Gratz his heirs and Assigns make do and execute or cause to be made done and executed all and every such further and other lawful and reasonable Act and Acts, thing and

(7) Things Device and Devices, Conveyance and Conveyances in

the Law whatsoever for the further better and more perfect granting Conveying and Assuring of all and Singular the said premises above mentioned unto the said Bernard Gratz his heirs and Assigns to the only proper Use and behoof of him the said Bernard Gratz his heirs and Assigns for ever as by the said Bernard Gratz his heirs and Assigns or his or their Council learned in the Law shall be reasonably devised or advised and required In Witness whereof the said George Croghan hath hereto set his hand and Seal the day and year first above written

Sealed and Delivered

Geo Croghan [L S]

In the presence of us

John Campbell

Joseph Simon

John Campbell

Memorandum Liviry and Seisin made by the said George Croghan to the said Bernard Gratz of all and singular the premises hereby conveyed or intended to be conveyed according to the true Intent and meaning of the within Indenture of Bargain and Sale, before the Signing Sealing and Delivery thereof Witness my hand the date within written

Geo Croghan

Received the day of the date of the within written Indenture of the within named Bernard Gratz Two thousand one hundred and one pounds nineteen Shillings lawful money of Great Britain being the full Consideration money in this written Indenture mentioned.

Witness

Geo Croghan

John Campbell

Joseph Simon

John Campbell

At a Court Continued and held for Augusta County at Fort Dunmore May the 18th 1775.

George Croghan Gent Acknowledged this his deed of Bargain and Sale with Livery and seisen and a Receipt thereon Endorsed to Bernard Gratz which is Ordered to be Recorded

Test JOHN MADISON Cl Cu

- (8) EXAMINED AND DELIVERED This Indenture
Bernard Gratz May 28th 1775 made the Six-
teenth day of May
in the year of our Lord One thousand seven hundred and seventy
five Between George Croghan of Pittsburgh Esquire of the one
part and Bernard Gratz of Philadelphia Merchant of the other
part Whereas Iohonorissa, Scarayadia and Coswantinecea chiefs
or Sachems of the six united Nations of Indians did by their deed
duly executed bearing date the second day of August in the year
of our Lord One thousand and Seven hundred and forty nine for
the Consideration therein specified grant bargain and sell unto
the said George Croghan in fee a certain tract or parcel of land
situate lying and being on the South side of the Monongahela
River Beginning at the mouth of a Run nearly opposite Turtle
Creek and then down the said Monongahela River to its Junc-
tion with the River Ohio computed to be ten miles then run-
ning down the Eastern Bank and sides of and unto the said
River Ohio to where Racoon Creek empties itself into the said
River thence up the said Creek ten miles and from thence on
a direct line to the place of beginning containing by Estima-
tion One hundred thousand Acres be the same more or less as
by the said Deed may more fully appear And Whereas certain
chiefs or sachems fully representing the six united nations afore-
said in full Council at Fort Stanwix assembled did by their
deed Poll duly executed bearing date the fourth day of Novem-
ber One thousand seven hundred and sixty eight for the Consid-
eration therein mentioned grant ratify and confirm unto his
most sacred Majesty George the third by the Grace of God
King of Great Britain France and Ireland & his heirs and Suc-
cessors for the use benefit and behoof of the said George
Croghan all the above bounded and described tract or parcel
of land and premises as by the said Deed Poll recorded in the
Office for recording of Deeds in the City and County of Phila-
delphia in Book J Volume the fifth page the two hundred and
thirty ninth &c may more fully and at large appear Now this
Indenture witnesseth that the said George Croghan for and in
Consideration of the sum of four thousand seven hundred and
twenty two pounds sixteen shillings and sixpence lawful money
of Great Britain to him the said George Croghan by him the

said Bernard Gratz in hand paid the receipt whereof he the said George Croghan doth hereby acknowledge hath granted bargained sold aliened released and confirmed and by these presents doth fully freely and absolutely grant bargain sell alien release and confirm unto the said Bernard Gratz and to his heirs and Assigns forever a certain Tract or Parcel of Land being a part or parcel of the aforesaid described tract of Land situate lying and being on the Waters of Robinson Run and Racoon Creek Beginning at a Stone on the said Croghan Boundary Line Corner to William Christy and running thence with the said Line S 44. 30 E 3065 Rod to a Stake on the said Line corner to James Innis thence with the said Innis's Line N 45 E 360 Rod to a Stake corner to said Innis, thence N 7 E (along the lines of Lots 21-25. 29. 36-39-45-50-54-60 and 75) 2697 Rod to a Stake on the Line of Edward Ward thence with the said Wards said Line N 63-45 W 1488 Rod to a Stake Corner to said Ward thence S 45. 45. W 976 Rod to a Stone corner to David Rogers and thence along said Rogers and said Christys Lines S 44 W. 854 Rod to the place of beginning containing thirty one thousand four hundred and eighty five and a half Acres with the Allowance of Six Acres pr Cent for Roads and high Ways with the Rights Members and appurtenances thereof and all Houses Edifices Buildings Orchards Gardens Lands Meadows Pastures Feedings Commons Trees Woods Underwoods Ways Paths Waters Water Courses Easement Profits Commodities Advantages hereditaments and appurtenances whatsoever unto the said tract of Land belonging or in any wise appertaining And also the Reversion and Reversions Remainder and Remainders Rents and Services of all and singular the said premises above mentioned and of every part and parcel thereof with the appurtenances And also all the Estate Right Title Interest Claim and Demand whatsoever both at Law and in equity of him the said George Croghan of in and to every part and parcel thereof with the Appurtenances To have and to hold the said Tract of Land Hereditaments and premises above mentioned and every part and parcel thereof (10) with the appurtenances unto the said Bernard Gratz his heirs and Assigns to the only proper Use benefit and behoof of him the said Bernard Gratz his heirs and Assigns for ever Subject

Nevertheless to the Quit Rents to grow and become due to his Majesty his heirs and Successors and to no other Incumbrance whatsoever And farther that he the said George Croghan and his heirs and every other person and persons and his and their heirs any-thing having or claiming in the said premises above mentioned or any part thereof by from or under him them or any of them shall and will from time to time and at all times hereafter upon the reasonable Request and at the Cost and Charges of the said Bernard Gratz his heirs and Assigns make do and execute or cause to be made done executed all and every such further and other lawful and reasonable Act and Acts Thing and Things Device and Devices Conveyance and Conveyances in the Law whatsoever for the further better and more perfect granting conveying and Assuring of all and singular the said premises above mentioned unto the said Bernard Gratz his heirs and Assigns to the only proper Use and behoof of him the said Bernard Gratz his heirs and Assigns for ever as by the said Bernard Gratz his heirs and Assigns or his or their Council learned in the Law shall be reasonably devised or advised and required In Witness whereof the said George Croghan hath hereunto set his hand and seal the day and year first above written

Geo Croghan [L S]

Sealed and delivered

In the presence of us

John Campbell

Joseph Simon

John Campbell

(11) Memorandum Livery and Seisin made by the said George Croghan to the said Bernard Gratz of all and singular the premises hereby conveyed or intended to be conveyed according to the true Intent and meaning of the within Indenture of Bargain and Seal before the Signing Sealing and delivery thereof Witness my hand the date within written

Geo Croghan

Received the day of the date of the within written Indenture of the within named Bernard Gratz four thousand seven hundred and twenty two pounds sixteen shillings and six pence

lawful money of Great Britain being the full Consideration money in this written Indenture mentioned

Witness

Geo Croghan

John Campbell

Joseph Simon

John Campbell

At a Court continued and held for Augusta County at Fort Dunmore May the 18th 1775

George Croghan Gent acknowledged this his Deed of Bargain and Sale with Livery and Seisen and a receipt thereon endorsed to Bernard Gratz which is ordered to be recorded

Test JOHN MADISON Cl Cu

EXAMINED AND DELIVERED

Joseph Simon, May 28th, 1775

This Indenture made the 9th day of July in the year

of our Lord One thousand seven hundred and seventy two Between George Croghan of Fort Pitt Esquire on the one part and Joseph Simons of Lancaster in the province of Pennsylvania Merchant on the other part Whereas Iohonorissa Scayradia and Caswantiecea chiefs or Sachems of the six united Nations of Indians did by their deed duly executed bearing date the Second day of August One thousand seven hundred and forty nine for the Consideration therein specified grant bargain and sell unto the said George Croghan in fee a certain tract or Parcel of Land sytuat lying and being on the south side of the Monongahela River beginning at a Run nearly opposite to Turtle Creek and then down the said Monongahela (12) River to its Junction with the River Ohio computed to be ten Miles then running down the Eastern Bank or side of the said River Ohio to where Racoon Creek empties itself into the said River thence up the said Creek ten miles and from thence on a direct line to the place of beginning containing by estimation One hundred thousand Acres be the same more or less as by the said Deed may more fully appear And Whereas certain Chiefs or Sachems fully representing the six united nations aforesaid in full Council at Fort Stanwix assembled did by their Deed poll duly executed bearing date the fourth day of Novem-

ber One thousand seven hundred and sixty eight for the Consideration therein mentioned grant ratify and confirm unto his most sacred Majesty George the third by the Grace of God King of Great Britain France and Ireland &c his heirs and Successors for the Use benefit and behoof of the said George Croghan all the above bounded and described tract or parcel of Land and premises as by the said Deed poll Recorded in the Office for recording of Deeds in the City and County of Philadelphia in Book J Volume the fifth page the two hundred and thirty ninth &c may more fully and at large Appear, Now this Indenture witnesseth that the said George Croghan for and in Consideration of the Sum of Six hundred and thirty pounds lawful Money of Great Britain to him the said George Croghan by him the said Joseph Symonds in hand paid he the said George Croghan doth hereby acknowledge And by these presents doth fully freely and absolutely grant bargain sell alien release and confirm unto the said Joseph Symonds (in his Actual possession now being by Virtue of a Bargain and Sale thereof to him made for one whole year by Indenture bearing date the day next before the date of these presents and by force of the Statute for transferring of Uses into possession) and to his heirs and assigns for ever a certain Tract or parcel of Land being a part or parcel of the aforesaid described tract of Land situate lying and being on Racoon Creek Beginning at a Stone being the most South West Corner of Eight thousand Acres of Land granted to Alexander Ross and others thence by the same Land and Lands of the said George Croghan South twelve Degrees East three hundred and Sixty five Chains to a Stone thence South forty four Degrees West One hundred and eighty Six Chains to where the Original bounds of the aforesaid tract Granted to the said George Croghan by the united Nations aforesaid cuts or intersects Racoon Creek at the South West side or Bank thereof thence by the said Original Bounds North forty four Degrees and thirty minutes West three hundred and ninety four Chains to a Stone Corner of one other tract of Land granted to Bernard Gratz thence by the same Land North fifty Degrees and thirty minutes East three hundred and seventy two Chains and ninety Links to another stone Corner of the said Gratz's Land, thence South fifty six Degrees and twenty

(13)

one Minutes East forty nine Chains and eighty Links to the place of beginning Containing ten thousand five hundred and eighty Acres with the Allowance of Six Acres pr Cent for Roads and highways with the rights Members and Appurtenances thereof and all the Advantages unto the Same belonging or in anywise appertaining And also all and Singular the Estate Right Title Interest Claim and Demand whatsoever both at Law and in equity of him the said George Croghan of in and to all and singular the said premises above mentioned and of in and to every part and parcel thereof with the appurtenances To have and to hold the said tract of Land Hereditaments and premises above mentioned with the Appurtenances and every part and parcel thereof unto the said Joseph Simons his heirs and assigns to the only proper Use and behoof of him the said Joseph Simons his heirs and assigns for ever, Subject nevertheless to the Quit Rents to grow and become due to his Majesty his heirs and Successors and to no other incumbrance whatsoever And further that the said George Croghan and his heirs and every other person and persons and his and their heirs any thing having or claiming in the said premises above mentioned or any part thereof by from or under him them or any of them shall and will at all times hereafter upon the Reasonable request and at the Cost and Charges of him the aforesaid Joseph Simonds his heirs and Assigns make do and execute or cause to be made done and executed all and singular every such

(14) other lawful and reasonable Act and Acts thing and things, Device and Devices, Conveyance and Conveyances in the Law whatsoever for the further better and more perfect granting of all and singular the said premises above mentioned unto the said Joseph Symonds his heirs and assigns to the only proper Use and behoof of the said Joseph Symons his heirs and assigns for ever As by the said Joseph Symons his heirs and Assigns or his or their Council Learned in the Law shall be reasonably advised devised and required In Witness whereof he the said George Croghan hath hereunto set his hand and affixed his Seal the day and year first above written being the 9th day of July 1772

Sealed and Delivered
In the presence of us
Bernard Gratz
Robt Lettis Hooper Junr

Geo Croghan [L S]

Received the day of the date of the written Indenture of
Joseph Simons Six hundred and thirty pounds lawful money of
Great Britain being the full Consideration in this deed mentioned
Witness

Geo Croghan

Robt Lettis Hooper Junr

Bernard Gratz

Bedford ss

Personally appeared before me Alexander McKee Esquire
one of his Majestys Justices of the peace for said County
Robert Lettis Hooper Junr and Bernard Gratz subscribing
witnesses to this Instrument in writing and being duly sworn
according to Law did say that they personally knew the said
George Croghan and saw him sign seal and deliver this
Instrument in writing as his Act and Deed and as such desired
it might be recorded Witness my hand and Seal this tenth day
of July 1772

Alex^r McKee [L S]

At a Court Continued and held for Augusta County at Fort
Drumore May the 18th 1775

George Croghan Gent acknowledged this his deed of Bar-
gain and Sale with a receipt thereon indorsed to Joseph Simons
Gent which is ordered to be recorded

Test JOHN MADISON Cl Cu

(15)

EXAMD & DELIVERED

Edward Ward, May 30th 1775.

This indenture
made the eigh-
teenth day of No-

vember in the year of our Lord One thousand seven hundred
and seventy three between George Croghan of Fort Pitt
Esquire of the one part and Edward Ward of the same place
Gent on the other part Whereas Iohonorissa Scarayadia and
Cawantinecea Chiefs or Sachems of the Six united Nations of
Indians did by their Deed duly executed bearing date the
second day of August in the year of our Lord One thousand
seven hundred and forty nine for the Consideration therein
specified grant bargain and sell unto the said George Croghan
in fee a certain tract or parcel of Land situate lying and being
on the South side of the Monongahela River beginning ten

Miles up the said River above the mouth of a Run nearly opposite Turtle Creek and then down the said Monongahela River to its Junction with the River Ohio computed to be ten miles then running down the Eastern Bank and sides of and unto the said River Ohio to where Racoon Creek empties itself into the said River thence up the said Creek ten miles and from thence on a direct line to the Place of beginning containing by Estimation One hundred thousand Acres be the same more or less as by the said Deed may more fully appear And Whereas certain Chiefs or Sachems fully representing the six united Nations aforesaid in full council at Fort Stanwix assembled did by their Deed Poll duly executed bearing date the fourth day of November One thousand seven hundred and sixty eight for the Consideration therein mentioned grant ratify and confirm unto his most sacred Majesty George the third by the Grace of God King of Great Britain France and Ireland &c his heirs and successors for the Use benefit and behoof of the said George Croghan all the above bounded & described Tract or parcel of Land and premises as by the said Deed Poll recorded in the Office for recording of Deeds in the City and County of Philadelphia in Book J Volume the fifth Page the two hundred and thirty ninth &c may more fully and at large appear Now this indenture witnesseth that the said George Croghan for and in consideration of the sum of four hundred and Eighty five pounds two Shillings lawful money of Great Britain to him the said George Croghan by him the aforesaid Edward Ward in hand paid the receipt whereof he the said George Croghan doth hereby acknowledge hath granted bargained sold aliened released and confirmed and by these presents doth fully freely and absolutely grant bargain sell alien release and confirm unto the said Edward Ward (in his actual possession now being by viture of a bargain and Sale thereof to him made for one whole year by Indenture bearing date the day next before the day of the date of these presents and by force of the Statute for transferring of Uses into possession) and to his heirs and Assigns for ever A certain tract or parcel of Land being a part or parcel of the aforesaid described tract of Land situate lying and being on the Branches of Montures or the half moon Run Beginning at a Stake on

Westfalls Line corner to David Price and running along the said Price's Line South 7° West 216 Rod to a Stake Corner to said Price and Thomas Joist and thence continuing the said Course along the said Joists Line 124 Rod in all 340 Rod to a Stake on the said Joists said Line thence North 63.45 West 1735 Rod to a Stake thence North 32.15 East 323 Rod to a Stake thence South 63.45 East 160 Rod to a Stake Corner to the said Edward Ward thence continuing the said course along the said Wards Line 814 Rod in all 974 Rod to a Stake Corner to the said Ward and John Westfall and thence continuing the said Course along the said Westfalls line 612 Rod in all 1586 Rod to the place of beginning containing three thousand two hundred and thirty four acres with the Allowance of Six Acres pr cent for Roads and Highways with the Rights Members and Appurtenances thereof and all houses Edifices Buildings Orchards Gardens Lands Meadows Pastures Feedings Commons Trees Woods Underwoods Ways Paths Waters Watercourses Easements Profits Commodities Advantages Hereditaments and appurtenances whatsoever unto the said tract of Land belonging or in anywise appertaining And also the Reversion and Reversions Remainder and Remainders Rents and Services of all and singular the said premises above mentioned and of every part and parcel thereof with the appurtenances And also all the Estate Right Title Interest Claim and Demand whatsoever both at Law and in Equity of him the said George Croghan of in and to all and singular the said premises above mentioned and of in and to every part and parcel thereof with the Appurtenances To have and to hold the said Tract of Land Hereditaments & premises above mentioned and every part and parcel thereof with the appurtenances unto the said Edward Ward his heirs and Assigns to the only proper Use benefit and behoof of him the said Edward Ward his heirs and Assigns for ever Subject nevertheless to the Quit Rents to grow and become Due to his Majesty his heirs and Successors and to no other Incumbrance whatsoever And farther that he the said George Croghan and his heirs and every other person and persons and his and their heirs anything having and Claiming in the said premises above mentioned or any part thereof by from or under

(17)

him them or any of them shall and will from time to time and at all times hereafter upon the Reasonable request and at the Cost and Charges of the said Edward Ward his heirs and Assigns make do and execute or cause to be made done and executed all and every such further and other lawful and reasonable Act and Acts thing and things Device and Devices, Conveyance and Conveyances in the Law whatsoever for the further better and more perfect granting conveying and assuring of all and singular the said Premises above mentioned unto the said Edward Ward his heirs and Assigns to the only proper Use of him the said Edward Ward his heirs and Assigns for ever As by the said Edward Ward his heirs or Assigns or his or their Council learned in the Law Shall be reasonably devised or Advised and required in Witness Whereof the said George Croghan hath hereto set his hand and Seal the day and year first above written

Sealed and Delivered

Geo: Croghan (Seal)

In the presence of us

N. B. The words on the other part in the fourth line of the first page and the word Ward in the Sixteenth line of the Second page were interlined before signing.

James Innis

John Campbell

Received the day of the date of the within indenture of the therein named Edward Ward the full and just sum of four hundred and eighty five pounds two Shillings Sterling or eight hundred pounds eight Shillings and three pence three fifths (18) Currt lawful money of Pennsylvania being the full Consideration money in the within written Indenture mentioned

Witness

Geo Croghan

James Innis

John Campbell

At a Court continued and held for Augusta County at Fort
Dunmore May the 20th, 1775

George Croghan Gent acknowledged this his Deed of Bargain and Sale with a receipt thereon Endorsed to Edward Ward Gent which is ordered to be recorded

Test JOHN MADISON Cl Cur

EXAMINED AND DELIVERED
Edward Ward, May 30th, 1775

This Indenture
made the eight-
teenth day of No-

vember in the year of our Lord One thousand seven hundred and seventy three between George Croghan of Fort Pitt Esquire of the one part and Edward Ward of the sd place Gent on the other part Whereas Iohonorissa Scarayadia and Coswantinecea Chiefs or Sachems of the Six United Nations of Indians did by their deed duly executed bearing date the second day of August in the year of our Lord One thousand Seven hundred and forty nine for the Consideration therein specified grant bargain and sell unto the said George Croghan in fee a certain tract or parcel of Land situate lying and being on the South Side of the Monongahela River beginning ten miles up the said River above the mouth of a Run nearly opposite Turtle Creek and then down the said Monongahela River to its Junction with the River Ohio computed to be ten miles then running down the eastern Bank and sides of and unto the said River Ohio to where Racoon Creek empties itself into the said River thence up the said Creek ten miles and from thence on a direct line to the place of beginning by Estimation One hundred thousand Acres be the same more or less as by the said Deed may more fully appear And whereas certain chiefs or Sachems fully representing the Six United Nations aforesaid in full Council at Fort Stanwix Assembled did by their Deed Poll duly executed bearing date the fourth day
(19) of November One thousand seven hundred and Sixty eight for the Consideration therein mentioned grant ratify and confirm unto his most Sacred Majesty George the third by the Grace of God King of Great Britain France and Ireland &c his heirs and Successors for the Use benefit and behoof of the said George Croghan all the above bounded and described tract or parcell of Land and premises as by the said Deed poll recorded in the Office for Recording of Deeds in the City and County of Philadelphia in Book J Volume the fifth Page the Two hundred and thirty ninth &c may more fully and at large appear. Now this Indenture witnesseth that the said George Croghan for and in Consideration of the sum of Five hundred and seventy seven pounds nineteen Shillings lawful money of Great

Britain to him the said George Croghan by him the aforesaid Edward Ward in hand paid the receipt whereof he the said George Croghan doth hereby acknowledge hath granted bargained sold aliened released and confirmed and by these presents doth fully freely and absolutely grant bargain Sell alien release & confirm unto the said Edward Ward (in his Actual possession now being by Virtue of a Bargain and Sale thereof made to him for one whole year by Indenture bearing date the day next before the date of these presents and by force of the Statute for transferring of Uses into possession) and to his heirs and assigns for ever a certain tract or parcel of Land being a part or parcel of the aforesaid described tract of Land situate lying and being on the Northern Bank of the Ohio River Beginning at a White Oak on the said Southern Bank of the said River and nearly opposite to the Lower end of the Long Island and likewise beginning to John Westfall and running with the said Westfalls Line South 32° . 15' West 760 Rod to a Stake Corner to said Westfall thence North 63.45 West 814 Rod to a Stake Thence North 32.15 East 928 Rod to an Elm on the said Southern Bank of the Ohio River and thence up the said Southern Side of the said River with the Meanders thereof South 46.30 East 24 Rod thence South 33.45 East 22 Rod thence South 25.15 East 54 Rod thence South 19.30 East 48 Rod Thence South 27 East 38 Rod thence South 22.45 East 4 Rod, thence South 47.15 East 54 Rod thence South 31.15 East 20 Rod thence South 44.30 East 48 Rod thence South 59.30 East 56 Rod thence South 71.15 East 112 Rod thence South (20) 62 East 56 Rod thence South 60.30 East 40 Rod thence South 79 East 14 Rod thence South 69.15 East 12 Rod thence South 61 East 32 Rod thence South 65.30 East 22 Rod Thence South 44 East 26 Rod thence South 56.45 East 88 Rod thence South 74 East 22 Rod and thence South 52.30 East 54 Rod to the place of beginning containing Three thousand eight hundred and sixty-three Acres with the Allowance of Six Acres Pr Cent for Roads and highways with the Rights Members and appurtenances thereof and all houses Edifices Buildings Orchards Gardens Lands Meadows Pastures Feedings Commons Trees Woods Underwoods Ways Paths Waters Watercourses Easement Profits Commodities Advantages Hereditaments and

the said River above at the
beginning of the Ninth line
of the first page were inserted
before signing —

James Innis

John Campbell

Received the day of the date of the within Indenture of the
therein named Edward Ward the full & just sum of five hun-
dred and seventy seven pounds nineteen Shillings Sterling or
nine hundred and fifty three pounds one penny and four fifths
Currt lawful money of Pennsylvania being the Consideration
Money in full in the within written Indenture Mentioned

Witness

Geo Croghan

James Innis

John Campbell

At a Court continued and held for Augusta County at Fort
Dunmore May the 20th 1775

George Croghan Gent acknowledged this his Deed of Bar-
gain and Sale with a Receipt thereon endorsed to Edward
Ward Gent which is Ordered to be recorded

Test JOHN MADISON Cl Cur.

(22)

EXAMINED AND DELIVERED
John McNess by your Order
October 15th 1776

This Indenture made
the eighteenth day of
November in the year
of our Lord one thou-

sand seven hundred and seventy four Between Michael & George
Kintner of the County of Augusta of y^e. one part and Francis
McBride of the County aforesaid of y^e. other part Witnesseth
that the said Michael & George Kintner for and in Considera-
tion of the sum of Five Shills current money of Virginia to
him in hand paid by y^e. said Francis McBride at or before
y^e. sealing and delivery of these presents the receipt whereof
is hereby acknowledged hath granted bargained and sold and
by these presents doth grant bargain and sell unto y^e. said
Francis McBride and his heirs a part of two tracts the one of
one hundred of One hundred and sixty acres first granted to

Jonathan Douglass and was by him conveyed to Nicholas Mace by Lease and release and was by him conveyed to said Kintners and 97 Acres a part of a tract of 200 Acres first granted by Pattent to said Kintners and Bounded as followeth viz Beginning at a 2 Black Oaks on Poages Line and thence North Sixty five degrees West Seventy Poles to a White Oak said Poages Corner and with his Line North 30 Degr East 176 Poles to a forked Black Oak & Th No 56 West 35 Pole to a White Oak and No 70 Degr West 50 Pole to Nicholas Maces Corner of said tract & So 29 West 174 Po to the line of that tract & thence So 39 West 150 Pole to a White Oak and Locust Saplin & So 62 East 124 poles to 3 hickey Grubs & thence and North East One hundred and twenty two poles to a White Oak and Locust and thence the same Course 20 po. to y^e. beginning Corner Containing Two hundred and fifteen Acres and all houses Buildings Ways Waters Watercourses profits commodities Hereditaments and appurtenances whatsoever to the said premises hereby granted or in any part thereof belonging or in anywise apertaining & the Reversion and Reversions Remainder and Remainders Rents Issues and Profits thereof To have and to hold y^e. said tract of Land and all and singular other the premises hereby granted with y^e. appurtenances unto the said Francis McBride his Executors Administrators and assigns from the day before the date hereof for and

(23) during the full term and time of One whole year thence next ensuing fully to be compleat and Ended Yeelding and Paying therefore the Rent of One Pepper Corn on Laddy Day next if the same shall lawfully be demanded to the Intent and purpose that by Virtue of these presents & of y^e. Statute for transferring Uses into possession on the said Francis McBride may be in Actual possession of the premises and be thereby enabled to accept and take a grant and release of y^e. Reversion & inheritance thereof to them and their heirs In Witness whereof the said Michael & George Kintner hath hereunto set their hands and Seals y^e. day and year first above written

Sealed and Delivered

Michael x Gindner [L S]

In the presence of

George GG Gindner [L S]

John Dunbar

John B Bailey

John Thomas

At a Court held for Augusta County at Fort Drumore May 16th 1775

Michael Ginder and George Ginder acknowledged this their lease for Land to Francis McBride and Ordered to be recorded

Test JOHN MADISON

This Indenture made the nineteenth day of November in the year of our Lord One thousand seven hundred and seventy four Between Michael Kintner and Catherine & George Kintner and Susanna his wife of the one part and Francis McBride of the other part Witnesseth That for and in Consideration of the sum of fifty six pounds fourteen Shillings and nine pence current money of Virginia to the said Michael & Catherine Kintner and George Kintner and Susanna in hand paid by the said Francis McBride at or before the Sealing and Delivery of these presents the Receipt whereof they do hereby acknowledge and thereof doth release acquit and discharge the said Francis McBride his Executors and Administrators by these presents them the said Michael and Catherine George Kintner & Susanna hath granted bargained sold aliened and confirmed and by these presents doth grant bargain sell alien and confirm to the said Francis McBride a part of two tracts of Land y^e one of one hundred and Sixty Acres first granted to Jonathan Douglass and was by him conveyed to Nicholas Mace by lease and release and was by him conveyed to said Kintners and 97 Acres a part of tract of 200 Acres first granted by Pattent bearing date to said Kintners and Bounded as followeth viz : — Beginning (24) at 2 Black Oaks on Poages Line and thence North Sixty five Degrees West seventy poles to a White Oak said Poages Corner and with his line No. 30 Degr East 176 poles to a forked Black Oak and thence No. 56 West 35 pole to a White Oak and No. 70 Degr West 50 poles to Nicholas Maces Corner of said tract & So 39 West 174 to the line of that tract & thence So 39 West 150 poles to a White Oak and Locust Saplin & So 62 Degr East 124 poles to 3 Hickory Grubs and then North East 122 Poles to a White Oak and Locust & thence y^e same Course 20 pole to the beginning containing two hundred and fifteen Acres and all houses Buildings Orchards Ways Waters Water Courses Profits Comodities Hereditaments & Appur-

tenances whatsoever to the said premises hereby granted or any part thereof belonging or in anywise appertaining and the reversion and reversions Remainder and Remainders Rents Issues and profits thereof And also all the Estate Right Title Interest Use trust Property Claim and Demand whatsoever of the said Michael & Catherine Kintner George Kintner and Susanna of in and to the said premises and all Deeds Evidences and Wrightings touching or in any wise concerning the same To have and to hold the Lands hereby conveyed and all and singular other the premises hereby granted and sold and every part and parcel thereof with their and every of their appurtenances to y^e said Francis McBride his heirs and Assigns for ever to y^e only proper Use & behoof of him the said Francis McBride & for his heirs their Executors and Administrators doth covenant promise & grant to and with the said Francis McBride his heirs and Assigns by these presents that the said Michael Kintner and Catherine George Kinter and Susanna now at the time of the Sealing and Delivery of these presents is seized of a good sure perfect and indefeasible Estate of inheritance in fee Simple of and in the premises hereby bargained and sold and that they have good power and lawful absolute Authority to grant and convey the same to the said Francis McBride in Manner and form aforesaid and that the said premises now are and so for ever hereafter shall remain and be free of and from all former and other Gifts Grants Bargain Sales Dower Right and Title of Dower Judgments Executions Titles Troubles Charges and Incumbrances whatsoever made done and Committed by the said Michael & G. Kintner or any other person or persons whatsoever (the Quit Rents hereafter to grow due and payable to our Sovereign Lord the King his heirs and Successors for and in respect of the premises only

(25) excepted and foreprised. And that the said Michael & Catherine Kintner George Kintner and Susanna and their heirs all and singular the premises hereby bargained and sold with the Appurtenances unto the said Francis McBride his heirs and Assigns against them the said Michael and Catherine George and Susanna and their heirs and all and every other person and persons whatsoever shall warrant and forever defend by these presents And lastly that them y^e said Michael Kintner

& wife and George Kintner and wife and their heirs and all and every other person and persons and their and their heirs anything having or claiming in the premises hereinbefore mentioned or intended to be hereby bargained and sold shall and will from time to time and at all times hereafter at the reasonable Request and at the proper Cost and Charges in Law of him the said Francis McBride his heirs and Assigns make do & execute or cause or procure to be made done and executed all and every such further & other lawful and reasonable Act and Acts, thing and things Conveyance and Assurances for the further better and more perfect conveying and Assuring the premises aforesaid with their and every of their appurtenances to the said Francis McBride heirs and Assigns as by the said Francis McBride his heirs & Assigns or their Council learned in the Law shall be reasonably devised advised or required In Witness whereof the said Michael Kintner & Catharine and George Kintner and Susannah hath hereunto set their hands and Seals the day and year first above written

| | |
|--------------------|----------------------------|
| Sealed & Delivered | George x Gindner (Seal) |
| In the presence of | George GG Gindner (Seal) |
| John Dunbar | Cathrine C. Gindner (Seal) |
| John B. Bailly | Susannah S Gindner (S L) |
| John Thomas | |

At a Court held for Augusta County May 16 1775

Michael Ginder & George Ginder acknowledged this their release for Land to Francis McBride and Ordered to be recorded
Test JOHN MADISON.

Augusta County to wit

(26) George the third by the Grace of God of Great Britain France and Ireland King Defender of the faith &c To Thomas Smallman and John Gibson Gentlemen Greeting Whereas Michael Kintner & Catherine and George Kintner and Susanna his wife by their certain Deeds of Lease and Release bearing date the 18 & 19th day of November 1774 for the consideration therein mentioned did give grant bargain and sell Alien release and Confirm unto Francis McBride two tracts of Land one Containing 160 Acres first granted to Jonathan Duglass and the other containing 97 Acres part of a tract granted the said

Kintners by Patent And Whereas Catharine and ^JSusannah the wives of the said Michael and George are unable to travel to our said County Court of Augusta to be privately examined apart from their said husbands and whether they voluntarily without the force threats or compulsion of their said husbands are willing to relinquish their Right of Dower to the said Lands in the said Deed mentioned as the Law in that Case directs— Therefore Know ye that We give Power and Authority to you the said Thomas Smallman and John Gibson to go to the houses of the said Michael and George and there to examine the said Catherine and Susannah privately and apart from their said husbands whether they are willing to relinquish their Right of Dower to the said Land in the said Deed mentioned and whether they do the same of their free will without any force threats or Compulsion of their said husbands and whether they are willing that their Acknowledgement shall be recorded with the said Deeds and that you certify the same distinctly to our Justices of our said County Court of Augusta and that you have then there the said Deeds together with this writ which we send you Witness John Madison Clerk of our said Court the 21st day of February 1775 in the 15 year of our Reign

JOHN MADISON

The Execution of this Writ appears by a Schedule hereunto annexed

(27) By Virtue of the within writ to us Thomas Smallman and John Gibson directed We did personally on the 21st day of February 1775 privately and apart from their said husbands examine Catherine & Susannah Ginder whether they are willing to relinquish their Right of Dower to the Lands sold by their said husbands to Francis McBride who declared and acknowledged that they freely and voluntary relinquished the same without the force threats or Compulsion of their said husbands and that they desired that the said Deeds together with this relinquishment of Dower by them made should be recorded in the County Court of Augusta all of which we do hereby certify to the Justices of our said Lord the King given under our hand and Seals this 21st day of February 1775—

Tho Smallman (L S)

John Gibson (L S)

At a Court held for Augusta County at Fort Dunmore May the 16th 1775

This Commission for the private Examination of Catherine the wife of Michael Gender & of Susanna the wife of George Gender to a tract of Land sold by their said Husbands to Francis McBride being returned is Ordered to be recorded

Test JOHN MADISON

EXAMINED AND DELIVERED

John McNess October 15th 1776 with
Private Examination by Order

This Indenture
made the eighth
day of November in the year

(28) of our Lord God one thousand seven hundred & Seventy four Between Michael & George Kintner of the County of Augusta of the one part and Nicholas Mace of the County aforesaid of the other part Witnesseth that for and in Consideration of the sum of five Shillings Current money of Virginia in hand paid by the said Nicholas Mace at or before the sealing and delivery of these presents the receipt whereof is hereby acknowledged hath granted bargained and sold and by these presents doth grant bargain and sell unto the said Nicholas Mace & to his heirs One certain tract or parcel of Land containing fifty Acres lying and being in the County of Augusta on the Branches of Brocks Creek being a part of two tracts the one of Two hundred Acres granted to said Michael and George Kintner by Pattent bearing date the Twenty sixth day of July One thousand seven hundred and sixty five And a part of a tract of thirty four Acres made over to said Kintners by Jonathan Douglass by Deeds of Lease & Release Dated y^e 14th & 15th days of November 1762 being all on the North side of a Ridge joining to said Maces other Lands and Bounded as followeth viz & Beginning at a Black Oak on a Ridge and thence No 29 Degrees East One hundred and ninety four poles to crossing both tracts to 2 Black Oaks on the Pattent Line & with the same North seventy West twenty poles to 2 White Oaks and hickory & So 41 Degrees West One hundred and eighty pole to a White Oak thence North Sixty five degrees West Thirty two poles to a Locust near a Branch and thence South Twenty eight West Twenty four poles to some White

Oak Grubs on a Ridge and thence South Sixty five East ninety four poles to the Beginning And all houses Buildings Orchards Ways Waters Water Courses Profits Commodities Hereditaments and Appurtenances whatsoever to the said premises hereby granted or any part thereof belonging or in any wise appertaining and the Reversion and Reversions Remainder and remainders Rents Issues and profits thereof To have and to hold the said tract of Land and all and Singular other the premises hereby granted with the appurtenances unto the said Nicholas Mace his Executors Administrators and Assigns from the day before the date hereof for and during and unto the end & term of one whole year from thence next ensuing fully to be compleat and ended yielding and paying therefore the Rent of One Ear of Indian Corn on the last day of the said Term if the same shall be lawfully demanded to the Intent and purpose that by Virtue of these presents and of the Statute for transferring Uses into possession the said Nicholas Mace may be in the more full and Actual possession of the said premises and be thereby the better enabled to accept and take a Grant and Release of the Reversion and Inheritance thereof to him and to his heirs In Witness Whereof the said Michael & George Kintner hath hereunto set their hands and Seals the day and year above written

Sealed and Delivered

in the presence of us

John Dunbar

his

John B Bayley

mark

John Thomas

Michal ^{his} × Gindner (L S)

George ^{his} GG Gindner (L S)

mark

- (29) At a Court held for Augusta County at Fort Dunmore May 16th 1775

Michael Ginder & George Ginder acknowledged this their Lease for Land to Nicholas Mace which is Ordered to be recorded

Test JOHN MADISON

This Indenture made the nineteenth day of November in the year of our Lord God One thousand seven hundred & Seventy

four Between Michael Kintner & Kaithrine his wife & George Kintner and Susannah his wife of the County of Augusta of the one part and Nicholas Mace of the County aforesaid of the other part Witnesseth that for and in Consideration of Twenty pounds Current Money of Virginia to the said Michael & Catherine Kintner and George Kintner & Susannah his wife in hand paid by the said Nicholas Mace at or before the Sealing and delivery of these presents the receipt whereof he doth hereby acknowledge and thereof doth release acquit and discharge the said Nicholas Mace his heirs and Assigns by these presents Them the said Michael Kintner & Catherine his wife and George Kintner and Susannah hath granted Bargained and Sold aliened released and confirmed And by these presents doth grant bargain Sell Alien release and confirm unto the said Nicholas Mace (in his Actual possession now being by Virtue of a Bargain and sale to him thereof made by the said Michael and George Kintner for one whole year by Indenture bearing date the day next before the day of the date of these presents and by force of the Statute for transferring Uses into possession) and his heirs One certain tract or parcel of Land containing fifty Acres lying and being in the County of Augusta on the Branches of Brocks Creek being a part of two tracts the one of Two Hundred Acres granted to the said Michael and George Kintner by Pattent bearing date the twenty sixth day of July One thousand seven hundred and sixty five and a part of a tract of thirty four Acres made over to said Kintners by Jonathan Douglass by Lease and Release dated the 14th and 15th days of November 1762 being all on the North side of a Ridge joining to said Maces other Land and bounded as followeth viz: Beginning at a Black Oak on a Ridge and thence North Twenty nine Degrees East One hundred and ninety four poles crossing both tracts to two Black Oaks on the

(30) Patent line & with the same North Seventy Degrees West Twenty poles to Two White Oaks & a hickory and South forty one Degrees West One hundred and eighty poles to a White Oak and thence North Sixty five Degrees West thirty two poles to a Locust near a Branch and South Twenty eight West twenty four poles to some White Oak Grubs on a Ridge & thence South Sixty five East Ninety four poles to the beginning

and all houses Buildings Orchards Ways Waters Water Courses Profits Commodities Hereditaments and Appurtenances whatsoever to the said premises hereby granted or any part & parcel thereof with their and every of their appurtenances And the Reversion and Reversions Remainder and Remainders Rents Issues and Proffits thereof And also all the Estate Right Title Interest Use trust property claim and demand whatsoever of them the said Michael and Catherine Kintner & George Kintner of in and to the said premises and all Deeds Evidences & writings touching or in any wise concerning the same To have and to hold the said tract of and all and singular other the premises hereby granted and released and every part and parcel thereof with their and every of their appurtenances to the said Nicholas Mace his heirs and Assigns forever to the only proper Use and behoof of him the said Nicholas Mace his heirs and Assigns forever. And the said Michael & Catherine & George and Susannah Kintner for themselves their heirs Executors & Administrators Doth covenant promise and grant to and with the said Nicholas Mace his heirs and Assigns by these presents That the said Michael & George Kintner now at the time of the Sealing and Delivery of these presents is seized of a good sure perfect and indefeisable Estate of Inheritance in fee Simple of in and to the said premises hereby granted and that he hath good power & lawful and absolute Authority to grant and convey the same to the said Nicholas Mace in manner & form aforesaid and that the said premises now are and so forever shall remain and be free and clear of and from all form and other Gifts Grants Bargains Sales Dower Right and Title of Dower Judgments Executions Titles Troubles Charges & Incumbrances whatsoever made done committed or suffered by the said Michael & Catherine Kintner and George & Susannah Kintner or any other person or persons whatsoever (the Quit Rents hereafter to grow due & payable to our sovereign Lord the King his heirs and Successors for and in respect of the said premises only excepted and foreprised) And lastly that the said Michael and George all and singular the premises with the appurtenances unto the said Nicholas Mace his heirs and Assigns against them the said Michael and Catherine Kintner & George Kintner & Susannah

& their heirs & all and every other person & persons whatsoever shall & will warrant and forever defend by these presents In Witness whereof the said Michael Kintner and Catherine his wife and George Kintner & Susannah his wife hath hereunto set their hands & Seals the day and year first above written

Sealed & Delivered

In presence of

John Dunbar

^{his}
John B Baily

^{mark}
John Thomas

Michael ^{his} × Gindner [L S]
^{mark}

George ^{his} GG Gindner [L S]
^{mark}

Catherine ^{her} C Gindner [L S]
^{mark}

Susannah ^{her} S Gindner [L S]
^{mark}

At a Court held for Augusta County at Fort Dunmore May the 16th 1775

Michael Ginder & George Ginder acknowledged this their Release for Land to Nicholas Mace which is Ordered to be recorded

Test JOHN MADISON

Augusta County to wit

(32) George the third by the Grace of God of Great Britain France and Ireland King Defender of the faith &c To Thomas Smallman and John Gibson Gentlemen Greeting Whereas Michael Kintner and Catharine his wife and George Kintner & Sussannah his wife by their certain Deed of Lease & Release bearing date the 18th & 19th day of November 1774 for the Consideration therein mentioned did give grant bargain sell alien and confirm unto Nicholas Mace fifty Acres of Land on the branches of Brocks Creek And Whereas Catherine & Susannah the wives of the said Michael and George are unable to travel to our said County Court of Augusta to be privately examined apart from their said husbands and whether they voluntarily and without the force threats or Compulsion of their said Husbands are willing to relinquish their Right of Dower to the said Lands in the said Deed mentioned as the Law in that Case directs Therefore Know ye that we give power & authority to you the said Thomas Smallman & John

Gibson to go to the house of the said Michael & George and thereto examine the said Catherine & Susannah privately and apart from their said Husbands whether they are willing to relinquish their Right of Dower to the said Land in the said Deeds mentioned and whether they do the same of their own free will without any force threats or compulsion of their said Husbands & whether they be willing that their Acknowledgement shall be recorded with the said Deeds and that you certify the same distinctly to our Justice of our said County Court of Augusta and that you have then there the said Deed together with this writ which we send you Witness John Madison Clerk of our said Court the 21st day of Feby. 1775 in the 15 year of our reign

JOHN MADISON

The Execution of this Writ appears by a Schedule hereunto annexed :

By Virtue of the within Writ to us Thomas Smallman & John Gibson directed we did personally on the 21st day of Feby 1775 privately and apart from their said Husbands examine Catharine & Susannah Kintner the Wives of Michael & George Kintner whether they are willing to relinquish their Right of Dower to the Land sold by their said Husbands to Nicholas Mace who declared and acknowledged that they freely and voluntarily relinquished the same without the force threats or Compulsion of their said husbands and that they desired that the said Deeds together with this relinquishment of dower by them made should be recorded in the County Court of Augusta all which We do hereby certify to the Justices of our said Lord the King Given under our hands & Seals this 21st day of Feby. 1775 :

Tho Smallman [L S]

Jno Gibson [L S]

At a Court held for Augusta County at Fort Dunmore May 16th 1775

This Commission for the private Examination of Catherine the wife of Michael Ginder and of Susannah the wife of George Ginder to a tract of Land sold by their husbands to Nicholas Mace being returned is ordered to be recorded

Test JOHN MADISON

(33)

EXAMD & DELIVERED

By Captn Charles

Major Edward Ward June 6th 1775

Edmonstone commanding his Maj-

estys Forces on the Communication to Fort Pitt Permission is hereby granted to Mr. Alexander Ross Agent for the Contractors for Victualling his Majestys forces in North America to use and improve a certain piece of Ground adjoining his Majestys fields at Fort on which he purposes to cultivate and raise Corn & Meadow and at some considerable expense therefrom supply this Garrison with fresh provisions Under this restriction Nevertheless that he is to give free and immediate possession to the Commanding officer at this Garrison whenever and at whatever time it shall be demanded he repaying the said Alexander Ross all the Costs and Charges accruing on & by the Cultivation and Improvement of said piece of Ground Given under my hand this Nineteenth day of September 1768

Chas Edmonstone Capl

Commanding

I Alexander Ross do by this Indenture for and in Consideration of one hundred pounds to me pd the receipt whereof I do hereby acknowledge bargain sell make over and Assign my right Title and claim to all the Estate mentioned in the within permit to Maj. Edward Ward his heirs & assigns for ever To have and to hold the same together with all the issues profits immunities and hereditaments whatsoever thereunto belonging hereby binding myself my heirs Exors & Admtrs to warrant and defend the same against the Claim or Claims of any person or persons claiming under me Witness my hand and Seal this 15th day of December Anno Dom 1774

Signed Seal'd & Delivered

Alexander Ross [L S]

In the presence of

“My Right Title & Claim to”

being first interlined between
the third & Fourth lines

A McKee C. Graydon

John Free

At a Court Continued and held for Augusta County at Fort
Dunmore May 20th 1775 Alexr Ross Gen't acknowledged this

his Deed of Bargain and Sale to Edward Ward Gen't which is ordered to be recorded

Test JOHN MADISON

34)

EXAMINED & DELIVERED
Majr Edward Ward June 6th 1775

By Capt Charles
Edmonstone
Commanding

his Majestys Forces in the district of Fort Pitt Permission is hereby granted to Mrs Susanna Edmonstone to occupy and improve upon a piece of Ground containing ——— joining to what is commonly called the Kings Garden & Orchard, In Consideration of which she or her Assigns is to pay Twenty Shillings yearly if demanded and also to be subject to such regulations as may be ordered by the Commander in Chief or by the Commanding Officer of the District for the Good of his Majestys Service Given under my hand at Fort Pitt the 25th October 1767

Chas Edmonstone
Commanding

Know all Men by these presents That I Susannah Edmonstone now at Fort Pitt for and in Consideration of Twelve pounds Pennsylv Currency to me in hand paid by Alexander Ross the Receipt whereof I do hereby acknowledge have granted bargained sold and assigned and by these presents do grant bargain and sell and assign over unto the aforesaid Alexander Ross his heirs and Assigns all my Right Title and Interest to the within permit or Instrument of Writing for the piece of Ground therein mentioned In Witness whereof I have hereunto set my hand and seal this third day of November in the year of our Lord One thousand seven hundred & Seventy two

Signed Sealed and Delivered in the presence of
Susanna Edmonstone [L S]
Edw Hand

I Alexander Ross do by this Indenture for and in Consideration of Thirty pounds to me in hand paid the receipt whereof I do hereby acknowledge bargain sell & deliver make over and Assign my Right Title & Claim to all the Estate mentioned in the annexed permit from Charles Edmonstone to Susannah

Edmonstone and by her Assigned to me to Majr Edward Ward his heirs and assigns for ever To have and to hold the same together with the immunities & heriditaments thereunto in anywise belonging Hereby binding myself my heirs Exors & Admrs to warrant and forever defend the same against the Claim or claims of any person or persons whatsoever claiming under me Witness my hand and seal the 15th day of Dec. 1774.

Sign'd Seal'd & Delivered Alexander Ross [L S]

in presence of us

“my Right Title & Claim to”

being first interlined between

the Second & third lines

A McKee C Graydon

John Feree

At a Court continued and held. for Augusta County at Fort Dunmore May 20th 1775

Alexander Ross Gent acknowledged this his Deed of Bargain and Sale to Edward Ward Gent which is ordered to be recorded

Test JOHN MADISON

| | |
|--------------------------------|----------------|
| EXAMINED & DELIVERED | By Captain |
| Majr Edward Ward June 6th 1775 | Charles Edmon- |
| | stone Com- |

manding his Majestys Forces in the District of Fort Pitt — Permission is hereby granted to Edmund Prideux to possess Till and Occupy a certain piece of Ground containing Seven Acres and eight chains Bounded and adjoining a piece of Ground called the Kings Orchard & Brick Pounds In Consideration of which he or his Assigns is to pay twenty Shillings yearly if demanded and also to be subject to such regulation as may be ordered by the Commander in chief or by the Commanding Officer of the district for the Good of his Majestys Service — Given under my hand at Fort Pitt the 8th of May 1771

Chas. Edmonstone
Commanding

Know all Men by these presents That I Edmund Prideaux Ensign in the 18th Regiment now at Fort Pitt for and in Consideration of the sum of Fourteen pounds Pennsylvania Cur-

- (36) rency to me in hand paid by John Campbell the receipt whereof I do hereby acknowledge have granted bargained sold and Assigned and by these presents do grant bargain sell and assign over unto the aforesaid John Campbell his heirs and Assigns all my Right Title and Interest to the within Permit or Instrument of writing for the piece of Ground therein mentioned In Witness whereof I have hereunto set my hand and seal this Sixteenth day of November in the year of our Lord One thousand seven hundred and seventy two

Signed Sealed & Delivered Edmd Prideaux [L S]
in the presence of
Alexander Ross

I assign over all my Right and Title of the above Permit or Instrument of writing unto Alexander Ross for the piece of Ground therein mentioned as Witness my hand & Seal this twenty Seventh day of Augt One thousand seven hundred and seventy three

Witness John Campbell [L S]
William Richmond

I Alexander Ross do by this Indenture for & in Consideration of thirty pounds to me paid the receipt whereof I do hereby acknowledge bargain sell make over & assign my Right Title & Claim to all the Estate mentioned in the annex'd permit granted by Charles Edmonstone to Edmund Prideaux by him assigned to John Campbell and by him to me to Majr Edward Ward his heirs and Assigns for ever To have and to hold the same together with all the issues profits and immunities & Hereditaments thereunto in anywise belonging Hereby binding myself my heirs Ex^{or} & Adm to warrant and for ever defend the same against the Claim or Claims of any person claiming under me Witness my hand and seal this 15th day of Decr 1774

Sign'd Seal'd & Deliver'd Alexander Ross [L S]
in the presence of
"my Right Title & Claim to"
being first interlined between
the second & third lines
A McKee C Graydon
John Free

(37) At a Court Continued and held for Augusta County at Fort Dunmore May the 20th 1775

Alexander Ross Gent acknowledged this his Deed of Bargain & Sale to Edward Ward Gent which is ordered to be recorded

Test JOHN MADISON

EXAMINED & DELIVERED By Major Charles
Majr Edward Ward June 6th 1775 Edmonstone Com-
manding his Maj-

estys Forces in the District of Fort Pitt—Permission is hereby granted to William Thompson and Alexander Ross to possess till and occupy a certain piece of Ground containing bounded and adjoining a piece of Ground claimed by John Campbell and John Donne including what is called the Kings and Artillery Gardens with the Orchards &c and the Brick ponds In Consideration of which they or their Assigns is to pay Twenty Shillings yearly if demanded And also to be subject to such Regulations as may be ordered by the Commander in chief or by the Commanding Officer of the District for the good of his Majestys Service—

Given under my hand at Fort Pitt the 28th of October 1772

Charles Edmonstone
Commanding

Know all men by these presents that We Charles Edmonstone Esqr Major, Edmund Prideux and Edward Hand Ens¹⁸ in the 18th Regiment now at Fort Pitt for and in Consideration of the sum of Thirty five pounds Pensylva Currency to Us in hand paid by William Thompson & Alexander Ross the receipt whereof we do hereby acknowledge have granted bargained sold and assigned and by these presents do grant bargain sell and assign over unto the said Thompson and Ross their heirs and assigns all our Right Title & Interest to what is commonly called the Kings fields Gardens and Orchard together with all other Improvements made by us and in our possession As Witness our hands and seals this 28th day of October 1773

Charles Edmonstone [L S]
for myself & Ensijn Prideaux
Edwd Hand [L S]

(38) Know all whom it may concern That I Alexander Ross have for and in Consideration of Forty pounds to me pd the Rect whereof I hereby acknowledge bargained sold granted and made over and by these presents do bargain sell grant and make over and assign Thompson and Ross Right Title and Claim to all and singular the Estate mentioned in the within permit granted to William Thompson and Alexander Ross unto Major Edward Ward his heirs and Assigns for ever together with all the issues profits immunities & Hereditaments thereunto belonging of whatsoever kind And I do hereby warrant and forever defend the above mentioned Major Edward Ward his heirs and assigns the above named premises from the Claim or Claims of the aforesaid William Thompson or any other person or persons claiming under him or me, for the true performance of which I bind myself my heirs Exr & Admr by this Indenture Witness my hand and seal this 15th day of Dec Ann Dom. 1774

Sign'd Seal'd & Deliver'd
 "Thompson & Ross's Right Title
 and Claim to" being first inter-
 lined between the fifth & Sixth
 lines.

Alexander Ross
 for self & [L S]
 William Thompson

A McKee
 C Graydon
 John Free

At a Court continued and held for Augusta County at Fort Dunmore May 20th 1775

Alexander Ross Gent acknowledged this his Deed of Bargain and Sale to Edward Ward Gent which is ordered to be recorded

Test JOHN MADISON

| | |
|----------------------------------|--|
| EXAMINED & DELIVERED | This indenture |
| Jacob Bousman the 19th June 1775 | made this Thirty |
| | first day of De- |
| | cember in the year of our Lord One thousand seven hundred |
| | and seventy Between George Croghan of Fort Pitt Esquire on |
| | the one part and Jacob Bousman of said place of the other |

(39) part Whereas Iohonorissa Scarayadia & Coswantinicea Chiefs or Sachems of the Six United Nations of Indians did by their Deed duly executed bearing date the Second day of August in the year of our Lord one thousand seven hundred and forty nine for the Consideration therein specified grant bargain and sell unto the said George Croghan in fee a certain tract or parcel of Land situate lying and being on the South side of the Monongahela River beginning at the mouth of a Run nearly opposite the mouth of Turtle Creek and then down the said Monongahela River to its Junction with the River Ohio computed to be ten miles, then running down the Eastern Bank and sides of and unto the said River Ohio to where Racoon Creek empties itself into the said River Ohio thence up the said Creek ten Miles and from thence on a direct line to the place of beginning containing by Estimation one hundred thousand Acres be the same more or less as by the said deed may more fully appear And Whereas certain Chiefs or Sachems fully representing the Six United Nations aforesaid in full Council Assembled at Fort Stanwix did by their Deed poll duly executed bearing date the fourth day of November one thousand seven hundred and Sixty eight for the Consideration therein mentioned Grant bargain ratify and confirm unto his most sacred Majesty George the third by the Grace of God King of Great Britain France and Ireland &c his heirs and Successors for the Use benefit and behoof of the said George Croghan his heirs and assigns for ever all the above bounded and described tract or parcel of Land and premises as by the said Deed Recorded in the Office for Recording of Deeds in the City and County of Philadelphia in Book J Volume the Fifth Page the two hundred and thirty ninth &c may more fully and at large appear Now this Indenture witnesseth that the said George Croghan for and in Consideration of the sum of thirty pound sixteen Shillings lawful money of Great Britain to him the said George Croghan by him the said Jacob Bousman in hand paid the receipt whereof he the said George Croghan doth hereby acknowledge hath granted bargained sold aliened released and confirmed and by these presents doth fully freely and absolutely grant bargain sell alien release and confirm unto the said Jacob Bousman (in his actual

possession now being by Virtue of a bargain and sale thereof made to him for one whole year by Indenture bearing date the day next before the day of the date of these presents and by force of the Statute for transferring Uses into possession) and to his heirs and Assigns for ever a certain tract or parcel of Land being a part or parcel of the aforesaid described tract or parcel of Land situate lying and being on the West side of Shirtees Creek beginning at a Maple tree on the West side of said Creek thence North Eighty Six degrees West Seventy four perches to a Marked White Oak thence South sixty five degrees West forty seven and an half perches to a post set up on the West Bank of said Creek thence down the said Bank and side of the said Creek One thousand and four and three Quarter perches to the place of beginning Three hundred and eight (40) Acres and an half Acre with the Allowance of Six Acres pr Cent for Roads and highways with the Right Members and Appurtenances thereof and all houses Edifices Buildings Orchards Gardens Lands Meadows Commons Pastures feedings Trees Woods Underwoods Waters Water Courses Easements Profits Commodities Advantages Hereditaments and Appurtenances whatsoever unto the said tract of Land belonging or in anywise appertaining and also the reversion and Reversions Remainder and Remainders Rents and Services of all and Singular the said premises of every part and parcel thereof with the Appurtenances And also all the Estate Right Title Interest Claim and Demand whatsoever both at Law and in Equity of him the said George Croghan of in and to all and singular the said premises above mentioned and of in and to every part and parcel thereof with the appurtenances To have and to hold the said tract of Land Hereditaments & premises above mentioned and every part and parcel thereof with the Appurtenances unto the said Jacob Bousman his heirs and Assigns to the only proper Use Benefit and behoof of him the said Jacob Bousman his heirs and Assigns for ever Subject nevertheless to the full Quit Rents to grow and become due to his Majesty his heirs and Successors and to no other Incumbrance whatsoever And further that he the said George Croghan and his heirs and every other person or persons and his and their heirs anything having or claiming in the said premises above mentioned or

any part thereof by from or under him them or any of them shall and will from time to time and at all times hereafter upon the reasonable Request and at the Cost and Charges of the said Jacob Bousman his heirs and Assigns make do and execute or cause to be made done and executed all and every such further and other lawful and reasonable Act and Acts thing and things Device and Devices Conveyance & Conveyances in the Law whatsoever for the further better and more perfect granting conveying and assuring of all and Singular the said premises above mentioned unto the said Jacob Bousman his heirs and Assigns to the only proper Use and behoof of him the said Jacob Bousman his heirs and Assigns for ever as by (41) the said Jacob Bousman his heirs or Assigns or his or their Council learned in the Law shall be reasonably devised advised and required In Witness whereof the said parties to these presents that is to say the said George Croghan hath hereunto set his hand and seal the day and year first above written

Sealed and Delivered Geo : Croghan [L S]

In the presence of us

William Sells

Ann Girty

Received the day of the date of the within Indenture of the within named Jacob Bousman the sum of Thirty pounds and Sixteen shillings lawful money of Great Britain being the full Consideration Money in the said within written Indenture mentioned

Witness

Geo : Croghan.

William Sells

Ann Girty

At A Court held for Augusta County at Fort Dunmore May the 16 1775

George Croghan Gent acknowledged this his Deed of Bargain and Sale and a receipt thereon endorsed to Jacob Bousman which is ordered to be recorded

Test JOHN MADISON

This Indenture
made the thirty
first day of De-

cember in the year of our Lord One thousand seven hundred and seventy Between George Croghan of Fort Pitt Esquire of the one part and Benjamin Tate now of the same place Sergeant in his Majestys Eighteenth Regiment of foot of the other part Whereas Iohonorissa Scarayadia & Coswentinicea chiefs or Sachems of the six united Nations of Indians did by their Deed duly executed bearing date the second day of August in the year of our Lord One thousand seven hundred and forty nine for the Consideration therein specified grant bargain and sell unto the said George Croghan in fee a certain tract or parcel of Land situate lying and being on the south side the Monongahela River beginning at the Mouth of a Run nearly opposite to Turtle Creek and then down the said River Monongahela to its Junction with the River Ohio computed to be ten Miles then running down the Eastern Bank and sides of and unto the said River Ohio to where Racoon Creek Empties itself into the said River thence up the said Creek ten miles and from thence on a direct line to the place of beginning containing by estimation One hundred thousand Acres be the same more or less as by the said Deed may more fully appear And Whereas certain Chiefs or sachems fully representing the Six united Nations aforesaid in full council at Fort Stanwix Assembled did by their deed poll duly executed bearing date the fourth day of November One thousand seven hundred and sixty eight for the Consideration therein mentioned grant ratify and confirm unto his most Sacred Majesty George the third by the Grace of God King of Great Britain France & Ireland &c his heirs and Successors for the Use benefit and behoof of the said George Croghan all the above bounded and described tract or parcel of Land and premises as by the said Deed Recorded in the Office for recording of Deeds in the City and County of Philadelphia in Book J Volume the fifth Page the Two hundred and thirty nine &c. may more fully and at large appear Now this Indenture witnesseth that the said George Croghan for and in Consideration of the sum of Thirty eight pounds eight shillings lawful money of Great Britain To him the said

(42)

- (43) George Croghan by him the said Benjamin Tate in hand paid the receipt whereof he the said George Croghan doth hereby acknowledge hath granted bargained sold aliened released & confirmed and by these presents doth fully freely and absolutely grant bargain sell alien release and confirm unto the said Benjamin Tate (in his actual possession now being by Virtue of a bargain and sale thereof made to him for one whole year by Indenture bearing date the day next before the day of the date of these presents and by force of the Statute for transferring of Uses into Possession) and to his heirs and assigns for ever a certain tract or parcel of Land being a part or parcel of the aforesaid tract or parcel of the aforesaid described Tract of Land situate lying and being on the East side of Shirtees Creek beginning at a marked White Oak Tree on the East Bank of said Creek a Corner of William Lees Land thence by said William Lees Land South forty three Degrees East One hundred and seventy six perches to another marked White Oak tree another Corner of said William Lees Land thence South fifty degrees East One hundred and fifty five perches to a marked black Oak tree thence South Sixteen Degrees West One hundred and seventeen perches to a marked White Oak tree thence North eighty four degrees West One hundred and thirty eight perches to another marked White Oak tree thence South Twenty Seven degrees West forty Six perches to another marked White Oak Tree, thence West Sixty three perches to a marked Lyn Tree thence North fifty Degrees West thirty One perches to a marked Sugar Tree thence North eight degrees West eighteen perches to a post set up and marked on the East bank of said Creek thence down the East Bank and side of said Creek the different Courses thereof three hundred and ninety perches to the place of beginning containing three hundred and eighty four Acres with the Allowance of Six Acres Pr Cent for Roads & Highways with the Rights Members and appurtenances thereof and all Houses Edifices Buildings Orchards Gardens Lands Meadows Commons Pastures feedings Trees Woods Underwoods Ways Paths Waters Water Courses Easements Profits Commodities Advantages Heriditaments and Appurtenances whatsoever unto the said Tract of Land belonging or in any wise appertaining and also the Re-

version and Reversions Remainder and Remainders Rents and Services of all and Singular the said premises above mentioned and of every part and parcel thereof with the appurtenances And also all the Estate Right Title Interest Claim and Demand whatsoever both at Law and in Equity of him the said George Croghan of in and to all and singular the said premises above mentioned and of in and to every part and parcel thereof with the appurtenances To have and to hold the said tract of Land Hereditaments and premises above mentioned and every part and parcel thereof with the Appurtenances unto the said Benjamin Tate his heirs and Assigns to the only proper Use benefit and behoof of him the Benjamin Tate his heirs and Assigns forever Subject nevertheless to the Quit Rents to grow and become due to his Majesty his heirs & Successors and to no other Incumbrance whatsoever And further he the said George Croghan and his heirs and every other person & persons and his and their heirs anything having or claiming in the said premises above mentioned or any part thereof by from or under him them or either of them shall and will from time to time and at all times hereafter upon the reasonable Request and at the Cost and Charges of the said Benjamin Tate his heirs and Assigns make do and execute or cause to be made done and executed all and every such further and other lawful and reasonable Acts and Acts thing and Device and devices Conveyance and Conveyances in the Law whatsoever for the further better and more perfect granting conveying and Assuring of all and Singular the said premises above mentioned unto the said Benjamin Tate his heirs and Assigns to the only proper Use and behoof of him the said Benjamin Tate his heirs and Assigns for ever as by the said Benjamin Tate his heirs or Assigns or his or their Council learned in the Law shall be reasonably Devised or advised and required In Witness whereof the said Parties to these presents have hereunto set their hands and Seals the day and year first above written

Sealed and Delivered

Geo : Croghan [L S]

in the presence of Us before
signing the words "Eighteen
Perches" in the twentieth line
of the Second page being inter-

lined and the words " Benjamin
Tate " being wrote on Erasures
in the Second, third, Eleventh
Seventeenth Nineteenth and
Twentieth lines of the third page

John Campbell

Jacob Bousman

(45) Received the day of the date of the within Indenture of the
within named Benjamin Tate Thirty eight pounds eight Shil-
lings lawful money of Great Britain being the full consideration
Money in the said within Written Indenture mentioned

Geo Croghan

Witness

John Campbell

Be it remembered that on the thirty first day of December
Anno Domini 1770 Before me Charles Edmonstone Esquire
Captain in his Majestys 18th Regiment of foot commanding
the Garrison of Fort Pitt personally appeared the within named
George Croghan Esq who acknowledged the within written
Indenture to be his Act and Deed and desired the same may
be recorded as such Witness my hand and seal at Fort Pitt the
day and year above said

Chas Edmonstone [L S]

At a Court held for Augusta County at Fort Dunmore May
the 16th 1775

George Croghan Gent acknowledged this his Deed of Bar-
gain and Sale with a receipt thereon endorsed to Benjamin
Tate which is Ordered to be recorded

Test.

This Indenture
made the ninth
day of October in

the year of our Lord One thousand Seven hundred and seventy
two Between Benjamin Taite Sergt in his Majestys eighteenth
or Royal Regiment of Ireland of the one part and John Camp-
bell of the town of Pittsburgh County of Bedford and province
of Pensylvania of the other part Witnesseth that the said

Benjamin Taite for and in Consideration of the sum of Sixty Six pounds ten Shillings Pennsylvania Currency to him in hand paid by the said John Campbell the receipt whereof the said Benjamin Taite doth hereby confess and acknowledge he the said Benjamin Taite hath granted bargained and sold and by these presents doth grant bargain and sell unto the said John Campbell all that Plantation or tract of Land situate lying and being on the East side of Shirtees Creek opposite to Lands of Jacob (46) Bousman about eight miles from Fort Pitt with all the Improvements thereon and also the Reversion & Reversions Remainder and Remainders Rents and services of all and Singular the said premises above mentioned and of every part and parcel thereof with the appurtenances To have and to hold the said Lands and premises above mentioned and every part and parcel thereof with the appurtenances unto the said John Campbell his Executors Administrators and assigns for the only proper Use benefit and behoof of Joseph Simon James Milligan and John Campbell Merchants of Pittsburgh aforesaid their Executors Administrators & Assigns for ever Provided always and upon Condition That if the said Benjamin Taite his heirs and assigns do and shall well and truly pay or cause to be paid unto the said John Campbell his Executors Administrators or Assigns the full sum of Sixty six pounds ten shillings lawful Pennsylvania Money in and upon the first day of October next which will be in the year of our Lord One thousand seven hundred and seventy three without any Deduction or Abatement of Taxes Assessments or any other Impositions whatsoever either Ordinary or extraordinary that then and from thence forth these presents and everything herein contained shall cease determine and be void anything herein contained to the Contrary notwithstanding In Witness whereof both parties have hereunto interchangeably set their hands & Seals the day and year first above written

Sealed and Delivered

Benj : Tate Sergt [L S]

In the presence of

James Heron

Robert Elliott

Bedford County ss

(47) Before me John Fraser Esquire one of his Majestys Justices of the peace & for the County aforesaid personally appeared the above named Benjamin Tate and acknowledged the above Indenture to be his Act and Deed and desired the same may be recorded as such In Witness whereof I have hereunto set my hand and seal this thirteenth day of October 1772

John Fraser [L S]

Entered in the Office for Recording of Deeds in and for the County of Bedford in Book A Page 35 the twenty fourth day of December Anno Dom 1772 Witness my hand and seal of my office aforesaid

A^r S^t Clair.

At a Court Continued and held for Augusta County at Fort Dunmore May 20th 1775.

This Mortgage from Benjamin Tate to John Campbell Gent was produced and Ordered to be recorded

Test.

EXAMINED AND DELIVERED

John Campbell Oct 1775

I do hereby certify that Peter McGachney is in-

tituled to fifty Acres of Land agreeable to his Majestys Proclamation in the year 1763. And being desirous to locate the same in the County of Augusta if he can lay it on any Vacant Lands that has not been Surveyed by Order of Council & patented since the above proclamation you are hereby Authorised and required to survey the same—Given under my hand and seal this 24th day of September 1774

DUNMORE [L S]

To the Surveyor of Augusta County

Entered in the Surveyors Office the 17th May 1775 and requested to be located by the Assignee on his Improvements at y^e fort of Grants hill Pittsburg

To Major Crawford¹ to Execute THOS LEWIS, S A C²

¹ This was Col. Wm. Crawford, burned at the stake by the Indians in 1782.

² Surveyor of Augusta County, Virginia.

(48) I do hereby Assign all my Right and Title of the within Warrant of fifty Acres of Land to which I am intituled as a disbanded Soldier of the forty Second Regiment residing in America under his Majestys Proclamation of 1763 unto John Campbell Esq of Pittsburg he having paid me a valuable Consideration for the same therefore desire the same may be surveyed for him & a Patent issued out in his Name

Given under my hand this 17th May 1775

Witness

Peter P M^{his} McCachney
mark

John Gibson

Andrew Robertson

Thomas Russell

At a Court continued and held for Augusta County at Fort Dunmore May the 17th 1775.

Peter McCachney acknowledged this Claim of Land to John Campbell Gent which is ordered to be recorded

Test JOHN MADISON

Know all Men
by these presents
That I John

Ormsby of the Town of Pittsburgh Gentleman for and in Consideration of the sum of twenty four pounds lawful money of the Colony of Virginia to me in hand paid by Benjamin Johnston of Fredericksburgh in the said Colony the receipt whereof I do hereby acknowledge have granted bargained and sold and by these presents do grant bargain and sell unto the said Benjamin Johnston his heirs and Assigns Two certain Lotts in the said town of Pittsburgh situate within a Square of Ground in the Occupation of and being the property of the said John Ormsby viz the first to contain Sixty feet fronting the River Monongahela to begin at the Easternmost or South Easternmost Corner of the said Square and to extend back as far as the West side of the Second Street of the said Town, the other Lott containing Sixty feet front on said Second Street and opposite to the Lott now in the Occupation of Samuel Evalt it being the Corner Lott and to extend back as far as the Easternmost side of Third Street together with the appurtenances

(49)

thereto belonging To have and to hold the aforesaid described Lots of Grounds with the Appurtenances to the said Benjamin Johnston his heirs and Assigns to the only proper Use and behoof of the said Benjamin Johnston his heirs and Assigns for ever hereby warranting and defending the same hereby granted premises against all manner of Persons whatsoever Subject only to the Lord of the fee for Quit Rents that may become due for the said Lots and the expences of Patternting the same when requested the said John Ormsby shall and will make all and every Deed or Deeds for the Conveying the said Lots in fee simple subject as aforesaid unto the said Benjamin Johnston his heirs and Assigns for the true performance hereof I do hereby bind myself my heirs Executors and Administrators to the said Benjamin Johnston his heirs and Assigns in the penal sum of five hundred pounds like money firmly by these presents Witness my hand and seal the seventh day of May Anno Domini One thousand seven hundred and seventy four

Sealed and Delivered

John Ormsby [L. S.]

In the presence of us

Tho : Smallman

John Boyd

James Berwick

Received the day of the date of the within Deed the sum of twenty four pounds Virginia Currency being the Consideration therein mentioned

Witness

John Ormsby

At a Court continued and held for Augusta County at Fort Dunmore May 20th 1775

John Ormsby acknowledged this his deed of Bargain and Sale to Benjamin Johnston which is ordered to be recorded.

Test JOHN MADISON Cl Cu

EXAM AND DELIVERED

Wm Elliott Nov 15, 1776

Know all Men by
these presents that
I Robert Elliott of

Pittsburgh for and in consideration of the sum of One hundred and fifty pounds lawful money of Pensylvania to me in

(50) hand paid by William Elliott of the County of Augusta the receipt whereof I do hereby Acknowledge have granted bargained and sold and by these presents do grant bargain and sell unto the said William Elliott a certain Improvement Plantation and tract of Land situate of Forbes old Road and about twelve miles from Pittsburgh adjoining Lands now or late the property of Ephraim Douglas containing Nine hundred Acres with all my right and Title of in and to the same To have and to hold the said premises with the appurtenances to the said William Elliott his heirs and Assigns to the only proper Use and behoof of the said William Elliott his heirs and Assigns for ever Subject to the purchase money Interest and Quit Rent due to the Lord or the Lords of the fee thereof And I the said Robert Elliott against me or my heirs and against all manner of Persons whatsoever the Lord of the fee aforesaid only excepted the hereby granted premises to the said William Elliott his heirs and Assigns shall and will warrant and for ever defend by these Presents In Witness whereof I have hereunto set my hand and seal the twentieth day of May One thousand seven hundred and seventy five

Sealed and Delivered
in the presence of us

Robt Elliott (Seal)

John Irwin
Jno Gibson
Jas Berwick

At a Court Continued and held for Augusta County at Fort Dunmore May 20th 1775

Robert Elliott acknowledged this his deed of Bargain and Sale to William Elliott which is ordered to be recorded

Test JOHN MADISON

EXAMINED & DELIVERED
Hannah Aston December 7th 1775

Know all men by
these presents that
I James Cumber-

ford for and in Consideration of the sum of Sixty pounds v. c. to me in hand well and truly paid by George Aston the receipt whereof I do hereby acknowledge have bargained and sold and by these presents do grant bargain sell & assign and make

day of January in the year of our Lord One thousand seven hundred and seventy five 1775

Witness present

Valentine Thos D'Alton

Jacob Bousman

Simon ^{his}X Butler [L S]
mark

- (52) At a Court Continued and held for Augusta County at Fort Dunmore February 23d 1775

This Deed of Bargain and Sale from Simon Butler to George Aston was proved by Valentine Tho D'alton one of the Witnesses thereto and ordered to be recorded

Test JOHN MADISON

EXAMINED & DELIVERED

Hannah Aston 7th December 1775

Articles of Agree-
ment made and
concluded on by

and between Cornelius Doherty of the one part and George Aston of the other part Witnesseth that the said Cornelius Doherty doth covenant grant and agree with George Aston his heirs and Assigns, my heirs hereby doth covenant grant agree with the said George Aston to let him have a certain Quantity or parcel of Land the said Doherty having one third of the said Lands Aston hereby obtaining securing and getting for me a patent or lawful Right for the said Lands being about 3000 Acres more or less which the said Aston is to be at the expences attending the securing the said Lands and surveying &c which land I do hereby Warrant and Defend from all manner of Persons lawfully claiming the same (the Lord of the soil only accepted) said Lands lying on the Waters of Lower Traverse Creek joining Bostian Frederick on the one part and Abraham Kuykendal on the other part said Lands being now improved In Witness whereof I have hereunto set my hand and seal this 30th day of Jan'y 1775

Witness present

Valentine Tho D'Alton

Cornelius ^{his}A. Doherty [L S]
mark

^{his}Joseph J Kerswell
mark

At a Court Continued and held for Augusta County at Fort Dunmore February 23d 1775

This Agreement between Cornelius Doherty and George Aston was proved by Valentine Thomas D'Alton one of the Witnesses thereto and Ordered to be Recorded

Test JOHN MADISON [L S]

- (53) EXAMINED & DELIVERED This Indenture
Geo Morgan September the 29th 1775 made the Nine-
teenth day of Sep-
tember in the year of our Lord One thousand seven hundred
and Seventy five Between George Croghan Esquire of Pitts-
burgh of the one part and Thomas Lawrence of the City of
Philadelphia Esquire of the other part Whereas Iohonorissa
Scarayadia and Cosswantinecea Cheifs or Sachems of the Six
United Nations of Indians did by their deed duly Executed
bearing date the Second day of August in the Year of our Lord
One Thousand Seven Hundred and forty nine for the Consid-
eration therein Specified Grant Bargain and Sell unto the said
George Croghan in Fee a Certain Tract or Parcel of Land situ-
ate lying and being on the South side of the Monongahela
River Beginning at the mouth of a Run nearly Opposite Turtle
Creek and then down the said Monongahela River to its Junc-
tion with the River OHio computed to be ten Miles then run-
ning down the Eastern Bank and sides of and unto the said
River OHio to where Racoon Creek empties itself into the said
River thence up the said Creek ten Miles and from thence on a
direct line to the Place of beginning Containing by Estimation
One hundred Thousand Acres be the same more or less as by
the said Deed may more fully appear And Whereas certain
chiefs or Sachems fully representing the Six United Nations
aforesaid in full Council at Fort Stanwix assembled did by their
deed duly Executed bearing date the fourth day of November
One Thousand Seven hundred and Sixty Eight for the Consid-
eration therein Mentioned Grant Ratifie and Confirm unto his
Most sacred Majesty George the Third by the Grace of God
King of Great Britain France and Ireland &c his Heirs and
Successors for the Use Benefit and Behoof of the said George
Croghan all the above bounded and described Tract or Parcel
(54) of Land and Premises as by the said Deed Poll recorded in the

Office for recording of Deeds in the City and County of Philadelphia in Book J Volume the fifth page the two hundred and thirty ninth & may more fully and at large appear Now This Indenture Witnesseth that the said George Croghan for and in Consideration of the Sum of Two Thousand seven hundred & Eighty seven Pounds lawful Money of Great Britain to him the said George Croghan by him the aforesaid Thomas Lawrance in hand paid the receipt whereof he the said George Croghan doth hereby Acknowledge hath Granted Bargained Sold Aliened Released and Confirmed and by these Presents doth fully freely and absolutely Grant Bargain Sell Alien Release and Confirm unto the said Thomas Lawrance (in his Actual Possession now being by Virtue of a bargain and Sale thereof made to him for one Whole Year by Indenture bearing date the day next before the day of the date of these Presents and by force of the Statute for transferring of Uses into Possession) and to his Heirs and assigns forever a Certain Tract or Parcel of Land being a part or parcel of the aforesaid described Tract of Land situate lying and being on the southwestern side of the River OHio and bounded to the Northward by the Logs Town Tract and the Lands of Alexander Ross Esquire to the Westward by the Land of Joseph Simons, George Croghan Esquire and David Rodgers to the Southward by the Lands of Barnard Gratz and Major Edward Ward and to the Eastward by the River OHio Beginning at a Sassafra on the Southwestern Bank of the said River and Running S 78° W 320 perches to a Spanish Oak Corner to Alexander Ross Esquire thence with the said Ross's line S 12° E 820 Perches to a White Oak Corner to said Ross thence with the said Ross's line S 78° W 1748 perches to a Stake Corner to said Ross and Joseph Simons thence with the said Simons's line S 12° E 640 perches to a Stone Corner to said Simons and George Croghan Esquire thence with the said Croghans Line S 44° 30 E 964 perches and 20 links to a Stake

(55) Corner to a Stake Corner to said Croghan and David Rodgers thence continuing the said Cource with the said Rodgers's 336 perches Making in the whole 1300 Perches and 20 links to a Stone Corner to the said Rogers and Barnard Gratz thence with the said Gratz's line N 43° 15 E 977 Perches to a Stake Corner to Major Edward Ward thence with the said Wards line N

32° 15 E 323 perches to a Stake corner to said Ward thence with the said Wards Line S 63° 45 E 160 perches to a Stake Corner to said Ward thence with the said Wards line N 32° 15 E 928 Perches to an Elm on the said Southwestern Bank of the said River OHio Corner to the said Ward and thence down the said River on the said Southwestern side with the Various Courses thereof 1347 Perches to the Place of Beginning Containing Eighteen Thousand five hundred and Eighty Acres with the Allowance of six acres pr Cent for Roads and Highways with the Rights Mannerns and Appurtenances thereof and all Houses Edifices Buildings Orchards Gardens Lands Meadows Pastures Feedings Commons Trees Woods Underwoods Ways Paths Waters Watercourses Easements Profits Commodities Advantages Hereditaments and appurtenances whatsoever unto the said Tract of Land belonging or in anywise Appertaining and also the Reversion & Reversions Remainder and Remainders Rents and Services of all and Singular the said Premises above Mentioned and of every part and parcel thereof with the Appurtenances and also all the Estate Right Title Interest Claim and Demand whatsoever both at Law and in Equity of him the said George Croghan of in and to all and Singular the said Premises above Mentioned and of in and to every part and parcel thereof with the Appurtenances To have and to hold the said Tract of Land Hereditaments and Premises above Mentioned and every part and parcel thereof with the Appurtenances unto the said Thomas Lawrance his heirs and Assigns to the only proper use

(56) Benefit and Behoof of him the said Thomas Lawrance his heirs and Assigns forever Subject Nevertheless to the Quit Rents to grow and become due to his Majesty his Heirs and Successors and to no other incumbrance whatsoever And farther that he the said George Croghan and his Heirs and every other Person and Persons and his and their Heirs any thing having or Claiming in the said Premises above Mentioned or any part thereof by from or under him them or any of them shall and will from time to time and at all Times hereafter upon the Reasonable Request and at the Cost and Charges of the said Thomas Lawrance his heirs and Assigns make do and Execute or Cause to be made done and Executed all and every such further and other Lawful and Reasonable Act and Acts thing and things

Device and Devices Conveyance and Conveyances in the Law
 Whatsoever for the further better and more perfect Granting
 Conveying and assuring of all and Singular the said Premises
 above Mentioned unto the said Thomas Lawrance his heirs and
 assigns to the only proper use and Behoof of him the said Thomas
 Lawrance his Heirs and assigns forever as by the said Thomas
 Lawrance his Heirs and assigns or his or their Council learned
 in the Law shall be Reasonably devised or advised and Re-
 quired In Witness whereof the said George Croghan hath hereto
 set his hand and seal the day and year first above Written
 Sealed and Delivered Geo : Croghan [L S]
 in the Presence of us
 William Trent¹
 Geo Morgan²

Pittsburg September the Nineteenth One Thousand Seven
 hundred and Seventy five Received of Mr. Thomas Lawrance
 the sum of Two Thousand Seven hundred and Eighty seven
 pounds Sterlg Money of Great Brittain being the full Considera-
 tion Expressed in the above Deed as Witness my Hand
 Witnesses Geo : Croghan
 William Trent
 Geo Morgan

- (57) At a Court Continued & held for Augusta County at Pitts-
 burgh September the twenty third day of September 1775
 George Croghan Esquire Acknowledged this his deed of
 Bargain and Sale to Thomas Lawrance which is Ordered to be
 Recorded

Test JOHN MADISON

EXAMD & DELIVERED This Indenture
 John Gabriel Jones Sept 25th 1775 made the nine-
 tenth day of
 September One Thousand Seven Hundred and Seventy five Be-
 tween William Parkyson of the County of Augusta in the
 Colony of Virginia of the one part and John *Mitchell*¹ of the
 said County and Colony aforesaid of the other part being of

¹ See Introductory, ante p. 13.

² Colonel Geo. Morgan, Princeton, N. J., the Indian agent at Pittsburgh, subse-
 quently (1796) removing to "Morganza," in Washington County, Pennsylvania.

lawful Age that for and in Consideration of the sum of Twenty Pounds in hand paid hath put and placed himself Voluntary for the Space of Three years and three Quarters from the date of these presents and him the said William Parkyson to serve for the aforesaid term in the Capacity of a Servant and as such to demean himself According to his Wit Power and Ability and Agreeable to the Laws of this Colony and the said William Parkyson for himself his heirs or Executors doth Promise and agree to find the said Servant in Competent and Sufficient Meat Drink and Appara! Washing and Lodging and all other things fit and Necessary for a Servant and at the Expiration of the said Term to pay the Customary dues In Witness whereof both Parties have hereunto set their Hands and Seals the day and year above Written

Sign'd Sealed and Delivered John x McMullin¹ [L S]

his mark

in the presence of William Parkison [L S]

J G Jones

Benj^r Davis

Silas Zane

- (58) At a Court Continued and held for Augusta County at Pittsburg the 20th day of September 1775

This Indenture from John McMullin to William Parkyson was Proved by the Oaths of John Gabriel Jones and Benjamin Davis two of the Witnesses thereto and Ordered to be recorded

Test JOHN MADISON

EXAMINED & DELIVERED

John Jeremiah Jacobs October 8th 1775

Know all men by

these Presents that

I Robert Denbow

of the County of Westmoreland in the Province of Pennsylvania for and in Consideration of the Sum of fifteen Pounds to me in hand paid by Michael Cresap the receipt whereof I do hereby Acknowledge Have Bargained and Sold and by these presents do bargain and sell unto the sd Michael Cresap² one Tract or Parcel of Land Situate Lying and being in Westmore-

¹ So recorded ; was it John Mitchell or John McMullin who thus became an "indentured servant" ?

² Charged by Logan with having killed his relatives in the spring of 1774.

land County in the Province of Pens^a af^d adjoining the Lands of David Rogers and Joseph Brenton on the Monongahaly being part of a Larger tract of Land I purchased of James Brenton and Containing by Estimation two hundred and fifty acres To have and to hold the said Tract or Parcels of Land with all and Singular the Appurtenances thereto belonging unto the said Michael Cresap and his heirs forever and Whereas the said Michael Cresap hath allowed me the use and Occupation of the said Land for the Space of Six Months from the date hereof I do hereby further Covenant and agree with the sd Michael that I my heirs Executors or Administrators shall and will deliver up Possession of the said Land to the said Michael Cresap at or before the Expiration of the said Six Months from the date hereof In Witness whereof I have hereunto set my hand and Seal this twenty eighth day of September 1773

Signed Sealed and Delivered

Robert D Denbow [L S]
his
mark

in the Presence of

Geo Brent

Jo^s Dorsey

Henry Brenton

At a Court Continued and held for Augusta County at Pittsburgh September the 21st 1775

- (59) This Deed of Bargain and Sale from Robert Denbow to Michael Cresap Gent was proved by George Brent Gent one of the Witnesses thereto and Ordered to be recorded

Test JOHN MADISON

EXAMINED AND DELIVERED

John Jeremiah Jacobs October 8th 1775

Know all men by these presents that

I James Brenton of Augusta County Virginia Monongahela Settlement for and in Consideration of the Sum of Fifty Pounds Pennsylvania Currency to me in hand paid by Michael Cresap Senr the Receipt whereof I do hereby Acknowledge and my self fully Satisfyd have Bargained & sold and delivered and by these Presents do Bargain Sell and deliver a Certain Tract or Parcel of Land lying about one Mile distant from Monongahela River

and Bounded by the following persons John Adams on the North East Edward Dorsey on the East Thomas Brown West and Edward White on the North with all and singular the appurtenances thereunto belonging or in any ways appertaining Containing by Estimation about two hundred and fifty Acres be the same more or less To have and to hold the said Tract or Parcel of Land to him the said Cresap his heirs and assigns forever from and against me my heirs Executors Admr or Assigns and from and against all Manner of Person or Persons the Lord of the Soile Excepted only and shall and will forever Warrant and defend the said Land with the appurtenances In Witness whereof I have hereunto set my hand this 5th day of September 1775

Witness

James Brenton

the D mark of Robert Denbow

Jno Jer^l Jacobs

Interlined (the Lord of the Soil Excepted only) before the sealing and Delivery of these Presents

At a Court Continued and held for Augusta County at Pittsburgh September 21st 1775

This Deed of Bargain and Sale from James Brenton to Michael Cresap was proved by the Oath of John Jeremiah Jacobs one of the Witnesses thereto and Ordered to be Recorded

Test JOHN MADISON

(60)

EXAMINED & DELIVERED

Know all men

John Jeremiah Jacobs October 8th 1775

by these presents that I Josiah

Little of Mannilling Township Westmoreland County in Pennsylvania for the Valuable Consideration of Seven Pounds ten Shillings Pennsylvania to me in hand paid by John Corey of Springhill Township in said County the Receipt whereof I do hereby Acknowledge and myself therewith fully Satisfied Contented and paid have bargained Sold set over Released Conveyed and Confirmed and by these presents do bargain Sell Set over and Confirm and deliver unto the said John Corey his Attorney heirs Executrs Admrs and Assigns a Certain tract or parcel of Land Containing two hundred Acres be it more or

less as it is butted and bounded Easterly on the Lands of Andrew Rob &c Westerly on the Land of Isaac Willson and the Watters of the Middle run Northerly on the lands of sd Willson and Rob & Southerly on the Land of Hugh Gilmore at the Lick Called the Buffaloo Lick To have and to hold the above bargained and Mentioned Peice of land together with all its Improvements fences buildings timber Watter and Watter Courses with all the other priveledges and Appurtainances Whatsoever thereunto belonging or in anywise appertaining against any Lawfull Claims or demand of myself my heirs Executrs Admintrs or Assigns or any other person or persons Whatsoever Claiming the same (the Rites and Services belonging to his Lordship the proprietor herein only Excepted) and further I do hereby Certifie that at the time and untill the Execution of these presents I am Justly and lawfully seized of the said Premises by Virtue of a purchase made of the same (by me) from a Certain James Willson of this place which said

(61) peice of Land together with all the above said Priviledges and appurtenances I do hereby bind myself my heirs Executors Administrs and every of them to the said John Corey his heirs Exctr Admr and assigns to warrant and forever defend against the Claime or demand of the said Willson his heirs or assigns or any other person or persons whatsoever Claiming the same in testimony whereof I have hereunto set my hand and Seal this 18th day of March in the year of our Lord Christ One Thousand Seven hundred and seventy four 1774

Signed Sealed and delivered in presence of us

Josiah Littel [Seal]

John ^{his} × Pettijohn
mark

Know all men by these presents that I John Corey of Dunlaps Creek Settlem't for and in Consideration of the sum of Fifty Pounds Pennsylvania Curry to me in hand paid by Michael Cresap Senr the Rect whereof I do hereby Acknowledge have Bargained and by these Presents do Bargain and Sell unto the sd Cresap all the Tract or Parcel of Land Contained in the within Bill of sale from Josias Little to me dated the 18th of March 1774 together with all the appurtenances there-

unto Belonging or anyway appertaining but Nevertheless if the said John Corey can and do pay the said Michael Cresap his Certain Attorney heirs or Assigns within the space of twelve Months from the date hereof a Certain sum of Money Contained in a Bond from him to said Cresap of the 19th of Dec 1772 together with all Interest and Costs &c then this Bill of Sale to be Void and the Property of the within Mentioned Land to revert to me the said Corey as if such Bill of Sale had never been given but on the Contrary I do Promise to deliver to the said Michael Cresap or his Attorney Peaceable Possession when required by him or them and do and will forever Warrant and defend the said Land to him the said Cresap his heirs or Assigns against myself my heirs Executors or any other Person or Persons Whatsoever According to the true Intent and Meaning of these presents In Witness whereof I have hereunto set my hand and Seal this 1st day of September 1775

John Corey

(62) Witness

Jno Jerh Jacobs¹

At a Court Continued and held for Augusta County at Pittsburgh September 21st 1775

This deed of Bargain and Sale from John Corey to Michael Cresap Gent was proved by John Jeremiah Jacobs the Witness thereto and Ordered to be Recorded

Test JOHN MADISON

EXAMD & DELIVERED
Jacob Saylor

This Indenture
made the Eleventh
day of September

in the year of our Lord One Thousand Seven hundred and Seventy five Between Andrew Robinson of Pittsburgh Taylor of the one part and Jacob Saylor of the same place Gunsmith of the other part Witnesseth that the said Andrew Robinson in Consideration of the sum of five Shillings lawful Money of Pennsylvania and also for the securing of the sum of forty Pounds seven Shillings and one penny like lawful Money due to a Certain Benjamin Elliott for which said sum the said

¹ Michael Cresap's clerk in the Old Redstone storehouse ; subsequently married Cresap's widow.

- (63) Jacob Saylor stands bound by Recognizance for the said Andrew Robinson in the County Court of Bedford County in the Province of Pennsylvania he the said Andrew Robinson hath granted bargained and Sold and by these Presents doth grant bargain and sell unto the said Jacob Saylor a Messuage a Stable and four Lotts of Ground situate in the Town of Pittsburgh aforesaid whereon the said Andrew Robinson now lives with all the Improvements and Appurtenances thereunto belonging and all the right Title and property of him the said Andrew Robinson of in and to the same To have and to hold the aforesaid hereby granted Premises with the Appurtenances unto the said Jacob Saylor his heirs and assigns to the only proper Use and behoof of the said Jacob Saylor his heirs and assigns forever Subject only to the Purchase Money due and to become due to the Cheif Lord of Lords of the fee thereof and the aforesaid Andrew Robinson against him and his heirs and against all Manner of Persons claiming by from or Under him the aforesaid Premises unto the said Jacob Saylor his heirs and assigns shall and will Warrant and forever defend by these Presents Provided Nevertheless and it is hereby declared to be the true Intent and Meaning of these Presents that if the said Andrew Robinson shall and do on or before the tenth day of November next ensuing the date of these Presents well and truly pay and Satisfy the afore mentioned Sum of forty Pounds Seven Shillings and one penny together with all lawful Interest and Charges of Court and all Incident Expences accruing on the same and shall also indemnify and forever save harmless the said Jacob Saylor his heirs Executors and Administrators of and from the Payment of the said Judgment then this present Indenture to cease and be Void to all Intents and purposes as if the same had never been made in Witness Whereof the said Parties have hereunto set their hands and Seals the day and year afore written
- Sealed and Delivered
in the Presence of us
Ja^s Berwick
John Rossan
Jno McCallister
- Andrew Robrtson [L S]

At a Court held for Augusta County at Pittsburgh January 16th 1776

This Mortgage from Andrew Robinson to Jacob Saylor was proved by the Oaths of James Berwick and John McCallister two of the Witnesses thereto and Ordered to be certified.

Test JOHN MADISON

Know all men by
these presents that
I Mordecai Moses

(64) Mordecai of Pittsburg for and in Consideration of the Sum of Three Hundred Pounds Current Money of Pennsylvania to me in hand paid the Receipt whereof I do hereby Acknowledge Have Granted Bargained sold and delivered by these Presents Doth Grant Bargain Sell and deliver unto Joseph Simon one plantation and Improvement, situate lying and being on Sucks run near Pittsburg, and all houses buildings and appurtenances thereunto belonging and also two Copper Stills with all the utensils thereunto belonging and all the household furniture now in my Possession or belonging to me To have and to hold the said Plantation and Improvement with all the appurtenances thereunto belonging, and all and Singular other the premises hereinbefore mentioned unto the said Joseph Simons his heirs and assigns to the only proper use and behoof of the said Joseph Simon his heirs and assigns forever And I the said Mordecai Moses Mordecai for myself my heirs Exors and Administrators the said Plantation and Improvement with the Appurtenances thereunto belonging with all and Singular other the Premises herein before mentioned, unto the said Joseph Simon his heirs and assigns Will Warrant and forever defend — In Witness whereof I have hereunto set my hand and Seal this 19th day of July 1775

Mordecai M Mordecai [L S]

Testes

Jno Anderson
John Campbell
Robert Campbell

At a Court Continued and held for Augusta County at Fort Dunmore September the 20th 1775

This Deed of Bargain and Sale from Mordecai Moses Mordecai to Joseph Simon was proved by the Oaths of John Anderson and Robert Campbell two of the Witnesses thereto and Ordered to be Certified

Test.

This Indenture
made this twenty
sixth day of August

in the Year of our Lord One Thousand Seven Hundred and Seventy five Between William Dunbar of Manchac Settlement on the Mississippi of the one part and Charles Simms of Pittsburgh Attorney at Law of the other part Witnesseth that the said William Dunbar for and in Consideration of the Sum of Ninety three Pounds Sterling to him in hand paid by the said Charles Simms the Receipt whereof he doth hereby acknowledge, Hath Granted Bargained and Sold aliened and Confirmed and by these Presents doth Grant Bargain Sell Alien and Confirm unto the said Charles Simms his heirs and assigns one third part of a Certain Tract of Land situate lying and being on Raccoon Creek on the West side of the Laurel Hill in the County of Augusta Beginning at the most South Easterly corner of two thousand Eight hundred and Seventeen Acres of Land Granted to Alexander Ross by George Croghan Gent thence South twelve degrees East Sixty Eight Chains and thirty three links to a Corner of a Certain Tract of Land granted as aforesaid to Robert Lettis Hoopers Land South Seventy Eight degrees West four hundred and thirty seven Chains to another Corner of the said Hoopers Land thence North twelve degrees West Sixty eight Chains and thirty three links to a Corner of Alexander Ross's Land aforesaid thence
(65) by the said Alexander Ross's Land North Seventy eight Degrees East four hundred and thirty seven Chains to the place of Beginning containing two thousand Eight hundred and Seventeen Acres which said Tract of Land was sold Conveyed to the said William Dunbar by George Croghan Gent by deed bearing date the Ninth day of January in the year of our Lord One Thousand Seven hundred and Seventy two and all Houses Buildings Yards Gardens Orchards Ways Woods

Waters Water Courses Profits Commodities Hereditaments and Appurtenances whatsoever to the same belonging or in anywise Appertaining and the Reversion and Reversions Remainder and Remainders Rents Issues and profits thereof and also all the Estate Right Title Interest property Claim and demand of the said William Dunbar of in and to one third part of the aforesaid Tract of Land To have and to hold one third part of the above Mentioned Tract of Land and premises unto the said Charles Simms his heirs and assigns to the only proper use and behoof of the said Charles Simms his heirs and assigns forever And the said William Dunbar doth Covenant promise and Grant to and with the said Charles Simms that he the said William Dunbar his heirs and Assigns and all and every person or persons claiming by from or under him or them shall and will from time to time and at all times forever hereafter upon the request and at the Cost and Charges in the law make do and execute or cause or procure to be make done and Executed all and every such further and other lawfull and reasonable Act and Acts thing and things Conveyances and assurances in the Law for the better and more perfect granting conveying and assuring the hereby Granted Land and premises unto the said Charles Simms his heirs and assigns as by the said Charles Simms his heirs and assigns his or their Council Learned in the Law shall be reasonably advised devised and required In Witness whereof Alexander Ross Attorney for the said William Dunbar by Virtue of a power of Attorney from the said William Dunbar bearing date the twenty eighth day of February in the year of our Lord 1772 hath hereunto set the hand and affixed the Seal of the said William Dunbar the day and Year first above written

Signed Seald and Delivered

In presence of
C Graydon
James Mc Kee
Dan^l Brown

At a Court Continued and held for Augusta County at Pitts-
burgh April the 17th 1776

(66) This deed of Bargain and Sale from William Dunbar by his

Attorney Ross to Charles Sims was proved by the Oaths of Caleb Graydon and Daniel Brown two of the Witnesses thereto and Ordered to be Certified

At a Court Continued and held for Augusta County at Pittsburgh April the 18th 1776

This deed of Bargain and Sale from William Dunbar by his Attorney Alexander Ross to Charles Simms being formerly proved by the Oaths of Caleb Graydon and Daniel Brown two of the Witnesses thereto was this day further proved by the Oath of James McKee the other Witness thereto and Ordered to be recorded

Test

This Indenture
made this twenty
sixth day of Au-

gust in the Year of our Lord one thousand seven hundred and Seventy five Between Alexander Ross Esq of Pittsburgh in the County of Augusta and Colony of Virginia of the one part and Charles Simms Esq Attorney at Law of the same place of the other part Witnesseth that the said Alexander Ross for and in Consideration of the Sum of two hundred and two Pounds Sterling Money of Great Britain to him in hand paid by the said Charles Sims the receipt whereof he doth hereby Acknowledge Hath Granted bargained and sold aliened and Confirmed and by these presents Doth Grant Bargain and sell alien and Confirm unto the said Charles Simms his heirs and Assigns the following Lands that is to say, one half or equal Moiety of a Tract of Land situate on the Southwest side of the River Ohio above the Mouth of Raccoon Creek being part of the Bottom commonly called the long Bottom, beginning at a Swamp Maple Tree standing on the lower Bank of a Small run where it emptys into the River Ohio being the first run below Ryleys run which Run emptys itself into the river at the head the aforesaid long Bottom, then from the said Swamp Maple tree up the several Courses of the river Ohio to a Swamp'd Maple tree Marked on two sides With three notches on each side and a blaze above them for a Corner thence South forty five degrees West One hundred and forty three chains to a stone,

(67) thence North forty five degrees West One hundred and fifty three Chains to a Stake, (South Seventeen degrees East distant 17 links stands a white Oak tree mark'd A R) then from said stake, North forty five degrees East forty one Chains and fifty links to a stone thence along the bounds of a Tract of Land granted to Rob^t Lettis Hooper Junr South forty five degrees East thirty five Chains to a Stone corner of said Hoopers Land thence North forty five degrees East one hundred and Seventy Chains along the bounds of said Hoopers Land to the place of Beginning containing two thousand One hundred and Sixty seven Acres be the same more or less which said Tract of Land was sold and Convey'd unto the said Alexander Ross by George Croghan Gent by deed bearing date the ninth day of January in the year of our Lord One Thousand Seven hundred and Seventy two also one third part of a Certain Tract or parcel of Land situate lying and being on Raccoon Creek Bounded as followeth Beginning at a Stake from which stake south three degrees West distant hereby four links stands a Spanish Oak tree Mark'd with the letter A and a blaze above, thence from said stake South twelve degrees East sixty eight chains and thirty three links to a Corner of William Dunbars Land thence South Seventy eight degrees West four hundred and thirty seven Chains to another Corner of William Dunbars Land; thence North twelve degrees West Sixty eight Chains and thirty three links to a Stone from which stone North Eighty three degrees East distant Seventy six links stands a White Oak tree Mark'd with the Letter A and a blaze above, then from said stone North Seventy eight degrees East by Lands of the aforesaid George Croghan and Nathaniel Kerkendall four hundred and thirty seven Chains to the Place of Beginning containing two thousand Eight hundred and Seventeen Acres be the same more or less which said Land was sold and Conveyed by George Croghan to the said Alexander Ross by deed bearing date the Ninth day of January in the Year of our Lord One Thousand Seven Hundred and Seventy two and all Houses buildings Yards Gardens Orchards Ways Waters Water Courses profits Commodities Hereditaments and Appurtances whatsoever to the same belonging or in anywise Appertaining and the Reversion and Reversions Remainder and Remainders

Rents Issues and Profits thereof and also all the Estate Right Title Interest property Claim and demand either in Law or equity of him the said Alexander Ross of in and to the Moiety of the first Mentioned Tract and to one third of the last Mentioned Tract of Land To have and to hold the hereby Granted Land and premises unto the said Charles Simms his heirs and Assigns to the only proper use and behoof of the said Charles Simms his heirs and assigns forever and the said Alexander Ross doth hereby covenant promise and Grant to and with the said Charles Simms that he the said Alexander Ross and his heirs and all and every person or persons claiming by from or

(68) under him or them shall and will from time to time and at all times hereafter upon the request and at the Cost and Charges of the said Charles Simms his heirs or assigns make do and Execute or cause or procure to be made done and Executed all and every such further and other Lawfull and reasonable Act and Acts thing and things Conveyances and Assurances in the Law for the better and more perfect Granting conveying and assuring the before Mentioned Land and premises unto the said Charles Simms his heirs and assigns forever as by the said Charles Simms his or their Council learned in the Law shall be reasonably advised devised and required In Witness whereof the said Charles Simms hath hereunto set his hand and affixed his seal the day and year first before written

Sign'd Seal'd & Deliver'd

Alexr Ross [L S]

In presence of

C Graydon

James McKee

Received of the within named Charles Simms the within Mentioned Sum of two hundred and two Pounds Sterling Money of Great Britain being the Consideration within Mentioned Witness my hand this twenty sixth day of

Witness

Alexr Ross

C Graydon

James McKee

Danl Brown

At a Court Continued and held for Augusta County at Pittsburgh April the 17th 1776

This deed of Bargain and Sale from Alexander Ross to Charles Simms was proved by the Oaths of Caleb Graydon and Daniel Brown two of the Witnesses thereto and Ordered to be Certified

At a Court Continued and held for Augusta County at Pittsburg April the 18th 1776

This deed of Bargain and Sale from Alexander Ross to Charles Simms being formerly proved by the Oaths of Caleb Graydon and Daniel Brown two of the Witnesses thereto was this day further proved by the Oath of James McKee the other Witness thereto and Ordered to be recorded

Test

This Indenture
made this twenty
sixth day of Au-

(69) gust in the Year of our Lord One Thousand Seven Hundred and Seventy five Between Alexander Ross Esq of the Town of Pittsburg of the first part and Charles Simms of the same place Attorney at Law of the other part Witnesseth that the said Alexander Ross for and in Consideration of the Sum of Fifteen Pounds Current Money of the Province of Pennsylvania to him in hand paid by the said Charles Simms the receipt whereof he doth hereby acknowledge Hath granted Bargained and Sold and by these presents Doth Grant Bargain and Sell unto the said Charles Simms his heirs and assigns one equal half or Moiety of a Certain Quantity or parcell of Land situate in the Town of Pittsburg on the Bank of the Allegheny River and is the same Lott or parcell of Land whereon the said Alexander Ross formerly had a house, and all houses buildings yards Gardens Orchards Ways Waters Water Courses profits Commodities Hereditaments and appurtenances whatsoever to the same belonging or in any wise appertaining and the Reversion and Reversions Remainder and Remainders Rents Issues and profits thereof and also all the Estate Right Title Interest use trust property Claim and demand of the said Alexander Ross of in and to the said Moiety of the said Lott or parcel of Land, To have and to hold the said half or Moiety of the

(70) Gent in what manner and to such person or persons as to him shall appear best and most conducive to my Interest and for me and in my name to make and Execute such Deeds and Conveyances as may be necessary for transferring and Conveying my Right and Title to said Lands to any person or persons that may become Purchasers thereof or any part thereof hereby ratifying and Confirming whatever my said Attorney shall lawfully and legally do relative thereto In Witness whereof Alexander Ross Attorney for the said William Dunbar by Virtue of a Power of Attorney bearing date the 28th day of February 1772 hath hereunto set the hand and Affixed the Seal of the said William Dunbar

Signed Sealed & delivered Will Dunbar [L S]

in presence of

C Graydon

James McKee

Danl Brown

At a Court Continued and held for Augusta County at Pittsburg April 17th 1776

This Power of Attorney from William Dunbar by his Attorney Alexander Ross to Charles Simms was proved by the Oaths of Caleb Graydon and Daniel Brown two of the Witnesses thereto and Ordered to be Certified

At a Court Continued and held for Augusta County at Pittsburg April the 18th 1776

This Power of Attorney from William Dunbar by his Attorney Alexander Ross to Charles Simms being formerly proved by the Oaths of Caleb Graydon and Daniel Brown two of the Witnesses thereto was this day further proved by the Oath of James McKee the other Witness thereto and Ordered to be recorded

Test

Know all men by
these presents that
I Alexander Ross

for divers good Causes and Considerations me hereunto moving have made ordained Constituted and Appointed Charles Simms of Pittsburg Attorney at Law, my true and Lawfull at-

received by the editor have disclosed that these records have excited much interest both north and south of Mason and Dixon's Line. Their existence seems to have hitherto been wholly unknown to many of the historians of old Virginia. Our work, however, should be supplemented by a small addition.

It is only of late that the full significance of a portion of the contents of one of the deed books in the recorder's office for Washington County, Pennsylvania, has been understood. It is apparent that when Col. James Marshel, the first recorder of deeds for Washington County, had filled his first volume, marked Deed Book A, vol. 1, with deeds acknowledged before Washington County officials and recorded from January 1, 1782, to November 20, 1784, utilized for his next volume a book in which had been recorded a number of last wills that had been admitted to probate before the County courts of the District of West Augusta and Yohogania County, Virginia. These wills, with their probate, were first recorded in a manuscript volume, and the balance remaining blank was utilized by Colonel Marshel as his second volume, marked Deed Book B, vol. 1, by simply beginning his Washington County records with a deed recorded on November 20, 1784, and proceeding 410 pages until his last deed was recorded on April 25, 1786, when he struck the wills which had been recorded by Dorsey Pentecost, the Clerk of the old Virginia Courts, many years before.

It will be remembered that at the session of the County Court for the District of West Augusta, held on September 18, 1776, at Augusta Town (now Washington, Pa.), Dorsey Pentecost, who then lived on the East Branch of Chartiers Creek, in what is now North Strabane Township, Washington County, Pennsylvania, was appointed Clerk of Court in the stead of John Madison, and on December 23, 1776, he was reappointed, and a demand was made by the Court upon John Madison, Jr., Deputy of John Madison, to turn over to his successor the records then in his possession, which demand was refused, and process awarded to compel compliance: Vol. I of these ANNALS, pp. 567, 568; Vol. II, pp. 79, 81. On the organization of Washington County, Pennsylvania, Dorsey Pentecost, theretofore an ardent Virginian, became an ardent Pennsylvanian and a prominent official of that jurisdiction.

On account of the genealogical interest in the old wills referred to, brief abstracts of them will now be presented as a final instalment of these papers.

ABSTRACTS OF OLD VIRGINIA WILLS.

1. Ellis Ellis, of Redstone Settlement ; dated July 13, 1776 ; attested by Thomas Freeman, Thomas Prather and Leven Green ; proved November 20, 1776, at a court for the District of West Augusta : Beneficiaries, wife, Ann ; sons, Isaac, Thomas, Jonathan ; daughter, Ann.

2. Jacob Lamb, of Pigeon Creek in West Augusta County ; dated November 4, 1776 ; attested by John Crow, Andrew McClean, John Wright, Abraham Westfall, Archevil White ; proved¹ June 24, 1777 : Beneficiaries, brothers Peter, John ; brother-in-law George Kintner ; sisters Catharine, Susannah.

3. Job Robins ; dated August 10, 1777 ; attested by Joseph Brown, Francis Sprouse ; proved on August 25, 1777 : Beneficiaries, wife Rebecca ; sons Amos, James, John ; daughter Anne.

4. Jonathan Reed, of West Augusta, Colony of Virginia ; dated November 4, 1776 ; attested by Hugh McCreedy, Noah Fleaharty ; appoints Edward Cook and Dorsey Pentecost and Joseph Beckett, to settle and have adjusted all his late public accounts in regard to his virtualing the Troops stationed on the Ohio ; proved September 23, 1777 : Beneficiaries, wife Sarah ; sons John, Jonathan ; daughters Mary, Sarah, Martha, Ruth ; executors Edward Cook, wife Sarah, and Joseph Beckett.

5. Joseph Kirkwood, of Yohogania County, State of Virginia ; dated April 24, 1777 ; attested by Nicholas Little, George Galaspie, Robert Meek ; proved October 29, 1777 : Beneficiaries, wife Margaret ; son David ; unborn child, "the old woman," and Martha and Mary.

6. James Pearce, Yohogania County, State of Virginia ; dated February 15, 1778 ; attested by James Wall, Joseph Warne, Walter Wall ; proved March 24, 1778 : Beneficiaries, wife Sarah ; sons Andrew, Lewis, James, Stephen, Jonathan.

7. William Chaplin, of West Augusta, Colony of Virginia ; attested by Charles Bilderback, Elizabeth Swearingen, William Nation ; proved on March 23, 1778 : Beneficiaries, Abraham Chaplin, Isaac Chaplin, Elizabeth Swearingen, Mary Chaplin, William Chaplin, Vance Chaplin, —devises "one place at Cain Tuck."

8. John Vance, of Yohogania County in Virginia ; dated December 10, 1777 ; attested by William Crawford, Benjamin Wells, Samuel Hecks ; proved March 23, 1778 : Beneficiaries, wife Margaret, sons

¹ This and the wills following were all proved before the Yohogania County Court.

David, William (land on waters of Raccoon Creek joining Crohan's line), Moses ; daughters Elizabeth, Mary.

9. James Freeman, Schoolmaster, in the County of Yohogania ; dated July 3, 1778 ; attested by John Thompson, Gilbert Cameron ; proved August 26, 1778 : Sole beneficiary John McDonald, of the said county, farmer.

10. Abranam Vaughan, of Yohogania County, State of Virginia ; dated September 8, 1778 ; attested by Edward Hatfield, Christopher Brice, Thomas Gist ; proved September —, 1778 : Beneficiaries, son Richard, daughters Isabel and Hannah Comly ; devises a tract on "Harmon's Run, it being the place whereon I now reside."

11. Will of John Pearce, Senr., of Augusta County, Colony of Virginia ; dated March 19, 1776 ; attested by Dorsey Pentecost, Moses Coe, John Peters ; proved September —, 1778 : Beneficiaries, grandson Daniel, son of son Daniel ; sons Isaac, Elisha, Joseph, John, Jonathan, Andrew ; daughters Mary Smith, Sarah Watkins.

12. Catharine Lamb, of Yohogania County ; dated January 22, 1779 ; attested by Peter Swath, Henry Devore, Jeremia Washburn ; proved March —, 1779 : Beneficiaries, Catharine Kintner, Susannah Kintner ; executor, George Kintner, husband of daughter Susannah.

13. James Devoor, of Yohogania County, Virginia ; dated November 14, 1778 ; attested by Nicholas Depue, Tobias Decker, Daniel Depue, Jr. ; proved March —, 1779 : Beneficiaries, children Jacob, Andrew, Henry, John, Sarah Pearshal, Samuel ; children under age David, Moses, Catharine, Francis, James ; all his real estate, except the Ferry to sons David and Moses.

14. John Bleakly, of Frederick County, Virginia ; dated November 20, 1779 ; attested by John Wright, Samuel Burns ; proved March —, 1779 : Beneficiaries, mother Margaret Megill, Henry Megill, each £100 if they come to America ; Robert Bleakly, William Alexander.

15. Stephen Richards, of Yohogania County, Virginia ; dated March 1, 1780 : Beneficiaries, wife Elizabeth ; sons Mordecai, Stephen, Thomas. [Will not all copied, and no probate entered.]

16. James Ross, Gentleman, "of Racune Settlement in Yohogania County, Virginia" ; dated January 6, 1781 ; attested by James McClellan, James Ross ; proved March —, 1781 : Beneficiaries, wife Mary ; sons James, Moses, Robert, Andrew, John ; daughters, Hannah Andrews, Margaret Ross, Isabel Ross, Fabee Ross.

VI. THE TRILOBITES OF THE CHAZY LIMESTONE.

BY PERCY E. RAYMOND.

During the forty years which have elapsed since the distinguished Canadian paleontologist, Elkanah Billings, published his descriptions of Chazy fossils, almost nothing has been added to our knowledge of the fauna of the series of limestones which, in the Champlain region, immediately underlie the Lowville member of the Trenton Limestone. Billings, in the Canadian Naturalist and Geologist (1859), Decade Four of the Canadian Geological Survey (1859), and the First Volume of the Paleozoic Fossils of Canada (1865), added considerably to the very meager list of forms which Professor James Hall had described from the Chazy in the First Volume of the New York State Paleontology. Hall recognized seven species of trilobites, *Illænus arcturus* Hall, *Illænus crassicauda*? Wahlenberg, *Asaphus obtusus* Hall, *Asaphus marginalis* Hall, *Isotelus canalis* Conrad, *Isotelus gigas*? DeKay, and *Ceraurus* sp. undet. Of these, *Illænus crassicauda*? *Isotelus canalis*, *Isotelus gigas*? and *Ceraurus* sp. are so fragmentary as to be unrecognizable, and *Illænus arcturus* is a synonym for *Thalæops ovata* Conrad. The *Calymene multicoستا*? which Hall described in the same volume from the "Birdseye" of the Isle La Motte is probably the same species that was later described by Billings as *Amphion canadensis*.

Billings, in 1865, recognized eighteen species of trilobites in the Chazy fauna, distributed as follows: *Asaphus*, 2; *Amphion*, 1; *Amphyx*, 1; *Bathyurus*, 1; *Cheirurus*, 3; *Harpes*, 1; *Illænus*, 6; *Lichas*, 1; *Remipleurides*, 1; *Sphærexochus*, 1; total 18.

The species are:

| | |
|---------------------------------------|-------------------------------------|
| <i>Asaphus canalis</i> Conrad, | <i>Illænus vindex</i> Billings, |
| <i>Asaphus platycephalus</i> Stokes, | <i>Illænus clavifrons</i> Billings, |
| <i>Amphion canadensis</i> Billings, | <i>Illænus bayfieldi</i> Billings, |
| <i>Amphyx halli</i> Billings, | <i>Illænus globosus</i> Billings, |
| <i>Cheirurus satyrus</i> Billings, | <i>Illænus crassicauda</i> ? Hall, |
| <i>Cheirurus pompilius</i> Billings, | <i>Lichas minganensis</i> Billings, |
| <i>Cheirurus prolificus</i> Billings, | <i>Bathyurus angelini</i> Billings, |

Harpes antiquatus Billings, *Remipleurides canadensis* Billings,
Illænus arcturus Hall, *Sphærexochus parvus* Billings.

Of these species, *Asaphus canalis*, *Asaphus platycephalus*, and *Illænus crassicauda* ? are doubtfully identified, as was admitted by Mr. Billings. *Illænus arcturus*, *Illænus vindex*, and *Illænus clavifrons* are synonyms for *Thaleops ovatus*, and *Cheirurus prolificus* is a synonym for *Pseudosphærexochus vulcanus*, thus reducing the list to thirteen identifiable species, making sixteen good species in all up to the end of the year 1865.

Brainerd and Seely, who were the next to take up serious work on the formation, paid most of their attention to stratigraphy, and by wonderfully accurate work in a much faulted region showed, that, instead of three hundred feet of Chazy, as had been previously estimated, there were from seven to nine hundred feet in the typical region. They collected many fossils, but beyond a preliminary identification they did little with them at the time. Professor Seely in 1885 and 1902 described several species of sponge-like forms, but did not add to the list of trilobites. Brainerd and Seely did, however, send specimens to Professor R. P. Whitfield, who described a few new species (1881). Among them were two trilobites, *Lichas champlainensis*, founded on a pygidium, which probably belongs to the same species as Billings' cephalon of *Lichas minganensis*, and *Sao ? Lamotensis*. Walcott had, however, described a cranidium of this latter species in 1877 under the name *Arionellus pustulatus*, so that both of Whitfield's names become synonyms. Thus *Arionellus pustulatus* Walcott is the only new species of trilobite added between 1865 and 1904, making a total of seventeen recognizable species at the present time.

As is known to all students of the Ordovician, these species are described from very fragmentary material, and the early reports of the Canadian Survey are out of print and difficult to obtain. For this reason the writer proposes to redescribe and refigure all the old species, in order to make them available to students, and, at the same time, a review of the fauna has brought to light some eighteen forms not hitherto known to occur in the Chazy, thus doubling the trilobite fauna.

The collections on which this review is based have been accumulated by the writer during five season's work around Chazy, Valcour Island, and Crown Point, New York. A part of this collecting was

done for the writer's personal collection, while other parts of the material were obtained for the Cornell and Carnegie Museums. I am greatly indebted to Professor George H. Hudson, of the Plattsburgh Normal School, and to Professor Gilbert D. Harris, of Cornell University, for field assistance and advice, and for the loan of specimens, also to Professor Joseph F. Whiteaves, Paleontologist to the Canadian Geological Survey, for the loan of specimens. The figures were drawn by Mr. Sydney Prentice, draughtsman to the Section of Paleontology, Carnegie Museum.

ARTHROPODA.

Subclass TRILOBITA.

Order HYPOPARIA Beecher.

Family HARPEDIDÆ Barrande.

Genus *HARPES* Goldfuss.

Subgenus *HARPINA* Novák.

***Harpina antiquatus* Billings. (Plate 10, figure 1.)**

Harpes antiquatus Billings, 1859, Canadian Naturalist and Geologist, volume 4, page 469, figure 38.

Harpes antiquatus Billings, 1863, Geology Canada, page 133, figure 67.

Of the two species of *Harpes* in the Chazy limestone, the one named above is the commoner, and it may be distinguished from *Harpina ottawaënsis* chiefly by its smaller size, narrower cephalic border, and more anterior position of the ocelli. In the collections available to the writer this species is represented only by specimens of the cephalon, no trace of the thorax or pygidium having yet been found. The cephalon of an average specimen is about half an inch long, measured from the anterior edge of the border to the tips of the genal spines. The width is about the same.

DESCRIPTION.

Cephalon nearly semicircular in front, border narrow, concave, the genal angles extending back a distance equal to about half the whole length of the specimen, slightly incurved at the posterior ends. Eyes small, simple, situated on the highest point of the cheeks and opposite the anterior fourth of the glabella. Eye lines sharp and prominent,

running a little forward and inward to the front of the glabella. Outside the eyes are two raised lines running backward and outward down the steep slopes of the cheeks, nearly to the concave border. The cheeks are much steeper both at the sides and in front, than in *Harpina ottawaënsis*, and the glabella is more convex and more distinctly outlined. On the front, below each eye, is a depression starting from the front of the glabella and running backward around the middle of the slope of the cheeks.

The whole surface of the cheeks and border is thickly pitted, as is the top of the glabella, while the sides of the glabella and its lobes are smooth.

The neck ring is narrow and shows a median pustule.

A small specimen, 3 mm. long and 3.65 mm. wide, differs from the adult in being proportionally wider and in having the anterior end of the glabella and the ocelli relatively further forward. The border is nearly flat instead of concave, and the glabella shows traces of a second pair of furrows.

The following measurements show the proportions of the various parts. An average adult. Cephalon: length 8 mm.; width 9 mm.; from front to posterior margin of neck ring, 5 mm.; length of glabella 3.5 mm. Distance of eyes from glabella 1.25 mm.; eyes 3.75 mm. apart.

Smallest specimen. Cephalon: length 3 mm.; width 3.65 mm. Front margin to neck ring 1.8 mm.; glabella 1.3 mm. long; eyes 1 mm. apart.

Largest specimen. Cephalon; length 15.5 mm.; width 14.5 mm.

Locality. — This species is common in the lower limestones at Valcour, Valcour Island, and Chazy, New York, and occasionally occurs in the middle Chazy.

Harpina ottawaënsis Billings. (Plate 10, figure 2.)

Harpes Ottawaënsis Billings, 1865, Paleozoic Fossils Canada, Volume I, page 183, figure 166.

Harpina, cf. *Harpes ottawensis* Clarke, 1897, Paleontology Minnesota, Volume 3, part 2, page 757, figure 79.

Harpina ottawensis Weller, 1902, Paleontology New Jersey, Volume III, page 191, plate XIV, figures 1, 2.

Although the type specimens of this trilobite were obtained from the Trenton limestone, the Chazy specimens differ from the original

figure and description only in size. The cephalon figured by Billings from Ottawa is about an inch and a half long, while our specimens vary from an inch to an inch and a quarter in length.

DESCRIPTION.

Cephalon.—Glabella oblong, strongly convex, tapering toward the front. The first pair of glabellar furrows make distinct, rounded lobes, but reach only about half way to the median line. The second and third pairs of furrows are very faint, often not visible. Neck segment narrow and convex.

Cheeks strongly convex, highest at the eyes, sloping abruptly at the sides, but gently in front, where an angle of about 45° is made with the border. Eyes small, situated well forward and rather close to the glabella.

Border semi-circular in front, about five or six millimeters wide, becoming narrower back on the genal angles, which are prolonged about half the length of the cephalon behind the neck segment. The entire border and cheeks outside the glabella are thickly pitted, a single row of larger pits extending around the outside margin of the border and along the edge of the glabella. A double row of large pits marks the juncture of the convex cheeks with the concave border. Glabella and two small oval spaces outside the posterior glabellar lobes smooth, with the exception of a narrow space along the crest of the glabella, which is faintly punctate.

Measurements.—An average cephalon: length 25 mm.; width 26 mm. Anterior margin to neck segment, 13 mm.; glabella 7.5 mm. long; eyes 7 mm. apart, 1.5 mm. from side of glabella.

Another specimen is 30 mm. long, 27 mm. wide.

Locality.—Most abundant in the lower Chazy limestone in the rocks along the lake shore about a mile north of Valcour, New York. The figured specimen is in the writer's collection.

Family TRINUCLEIDÆ Barrande.

Genus AMPYX Dalman.

Subgenus LONCHODOMAS Angelin.

Lonchodomas halli Billings. (Plate 10, figures 3-7.)

Ampyx Halli Billings, 1861, On some new or little known species of Lower Silurian Fossils from the Potsdam Group. Geological Survey of Canada. Reprinted in volume I, Paleozoic Fossils of Canada, 1865, page 24, figure 25, a-c.

Ampyx Halli Billings, 1861, Geological Survey of Vermont, volume II, page 959, figure 365.

Ampyx halli Vodges, 1893, American Geologist, volume XI, page 106, figure 5.

One of the common trilobites of the Chazy limestone is the little *Ampyx* which Billings described from Highgate Springs, Vermont. In spite of the frequency with which it is met, no complete specimens have yet been found. Pygidia, although small, are frequently obtained, but of the thorax only the last two segments have been found.

An examination of the type specimen at Ottawa shows that the pygidium of that specimen has attached to it the last two thoracic segments, which explains the surprising length of the pygidium figured in the Paleozoic Fossils of Canada, page 24. A similar specimen was found by the writer on Valcour Island.

DESCRIPTION.

Cephalon. — Cranidium triangular, the greatest width at the neck segment. The glabella extends about half its own length beyond the anterior angles of the fixed cheeks, and is then prolonged into a long, fluted spine, which curves gently upward. This spine is prismatic, with a deep furrow on each of its four sides. The furrow on the upper side extends back to about the region of the fixed cheeks. Glabella widest at the anterior angles of the fixed cheeks and contracting posteriorly, so that it forms about one fifth of the whole width at the neck segment. On the cast there are two small nodes on each side of the glabella near its posterior end, one pair a little in front of the other. A distinct carina extends along the top of the glabella to the posterior end of the dorsal furrow on the rostrum.

Thorax. — A specimen from Valcour Island retains the last two segments of the thorax. They are narrow, extend horizontally, and on the pleura are deeply grooved. The fourth segment is 5 mm. wide, .3 mm. long, and the axis is 1.6 mm. wide. The pygidium of the same specimen is 1.25 mm. long, 4.3 mm. wide, and the axis is 1.3 mm. wide at the anterior end.

Pygidium. — The pygidium is about three times as wide as long, usually regularly rounded posteriorly, sometimes somewhat triangular. Axis wide, prominent, extending to the posterior end of the pygidium. The exfoliated axis shows seven to ten pairs of nodes very similar to those noticed by Ruederman on specimens of *Lonchodomus hastatus*

from Rysedorph Hill. The pleura show three or four pairs of rather indistinct ribs. The margin is abruptly deflected all around.

Very closely related to this species are *Ampyx normalis* and *Ampyx semicostatus* from the division P of the Quebec group in Newfoundland. The cranidium of *Ampyx normalis* has the same long fluted rostrum and the same scars on the cast of the glabella. The pygidium figured with *Ampyx normalis* does not greatly resemble that of an *Ampyx*, but the pygidium figured as *Ampyx semicostatus* differs from *Ampyx halli* only in size. The cranidium of *Ampyx normalis* differs from that of *Ampyx halli* in having the fixed cheeks much more extensive, as they extend to the base of the rostrum in the former species, and only about half that distance in the latter.

Locality. — The figured specimen is from Valcour Island. The species seems to occur in only a limited area in the region of the typical Chazy deposits. It has not been reported south of Valcour, New York, nor north of St. Dominique, Quebec. At Chazy the specimens are all found in one horizon, about the middle of the group. At Valcour it is common in the lower portion, and on Valcour Island it occurs from a horizon about three hundred feet above the base to within about one hundred feet of the top.

Order OPISTHOPARIA Beecher.

Family OLENIDÆ Salter.

Genus REMIPLEURIDES Portlock.

Remipleurides canadensis Billings. (Plate 10, figures 8–10.)

Remipleurides Canadensis Billings, 1865, Paleozoic Fossils Canada, Volume I, page 182, figure 164.

This interesting fossil can not be said to be common except in one or two small localities, although it has been found in a number of places. The best specimens so far obtained are from the dolomitic reef material on the east side of Valcour Island.

DESCRIPTION.

Cephalon. — Glabella high, nearly flat on top, but with steep sides and front. It occupies nearly three fourths of the whole width of the cephalon. Glabellar furrows very faint, three pairs showing on the cast, while the outer shell sometimes shows two pairs, but generally none. Surface finely granulose.

Neck furrow wide and deep, extending to the genal angles. Neck segment wide and convex, with a small tubercle close to the furrow.

Free cheeks small, extending only to the front of the eyes, strongly striated. Genal angles extended into small, short spines. Eyes very large, extending from the neck furrow around almost to the front of the glabella. Lenses very fine and very numerous.

Thorax. — No specimen in the collection shows the total number of thoracic segments, and the largest number on any fragment is eight. The median lobe is very wide toward the front, but tapers rapidly. The segments are beautifully adapted for rolling up, having a very neat interlocking device. At the sides of each segment are fulcral nodes, and processes which fit over the segment ahead and against its fulcral projection. The side lobes of the segments are short, obliquely furrowed, and turn back at angles of from 30° to 45° , the posterior ones turning back most sharply. The pygidium is small, and divided into four lobes which extend back as spines. On the anterior edge are two nodes similar to those on the thoracic segments. There are two large projections on the surface of the pygidium, and each is divided by a diagonal impressed line.

The following are the measurements of a couple of heads. An average cephalon: length 9.5 mm.; width 11 mm.; width of glabella at widest part 8 mm.; at anterior ends of eyes 5 mm. A larger cephalon is 12.5 mm. long, 16 mm. wide, and the greatest width of the glabella is 11 mm.

Locality. — Found in the middle Chazy on the east side of Valcour Island, New York, and also at Chazy. The figured specimens are from Smugglers Bay, Valcour Island.

Family ASAPHIDÆ Emmrich.

Genus *BATHYURUS* Billings.

***Bathyurus angelini* Billings.** (Plate 10, figures 11, 12.)

Paradoxides Logan, 1852, Quarterly Journal of the Geological Society of London, volume VIII, page 207. (Identified by Salter.)

Asaphus (or *Olenus*) Salter, 1859, Quarterly Journal of the Geological Society of London, Volume XV, page 555, figures 3, 4.

Bathyurus Angelini Billings, 1859, Canadian Naturalist and Geologist, Volume IV, page 467, figure 37.

This trilobite was described by Billings from the Chazy at Grenville,

Canada, and, so far as is known, it does not occur outside of the Ottawa Valley. Through the courtesy of Professor Joseph F. Whiteaves of

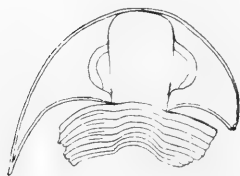


FIG. 1. Outline drawing of the type specimen of *Bathyrus angelini* Billings to show its distorted condition. $\frac{1}{3}$ nat. size.

the Dominion Survey, the writer has been enabled to study three specimens, including the type, and, in order to make this list of Chazy trilobites complete, figures of them are inserted here. The type specimen is in a bit of sandy shale, and is very much flattened and somewhat distorted by pressure. (See figure 1.) The other two specimens, a cranium and a pygidium, are in the characteristic upper Chazy limestone of the Ottawa Valley and are accompanied by great numbers of Ostracoda. They are both on weathered surfaces and retain their normal convexity. The

above line drawing is from the type specimen and the others are figured on plate 10.

DESCRIPTION.

Cephalon wide, moderately convex, the free cheeks extended back into sharp spines; glabella subcylindrical, extending almost to the front border, from which it is separated by a narrow groove. Two pairs of oblique glabellar furrows are faintly visible in the proper light. The first pair have their anterior ends just at the front of the eyes and their course is obliquely backward. The second pair originate opposite the middle of the eye lobes, run about parallel to the first pair, reaching nearly to the neck furrow. Eyes very large, close to the glabella, and reaching the neck furrow posteriorly. Free cheeks large, the suture running from the eye straight forward to the margin, close to the glabella. A narrow, striate, upturned border extends all around the front and sides of the cephalon.

Thorax. — The number of segments cannot be determined. The type specimen shows eight, but they are so pressed out of position that the thorax is much shorter than it should be and appears to taper too rapidly. Axis less than one third the width, strongly convex. Segments on the pleura are obliquely grooved.

Pygidium strongly convex, semicircular, with a narrow, depressed border. Axis very convex, smooth, but shows three or four pits at the sides near the anterior end. Instead of being abruptly terminated behind, as in *Bathyrus extans* Hall of the Black River limestone, the axis

extends to the posterior margin of the pygidium, tapering to a point there. The pleura bear four pairs of distinct furrows, and four pairs of pits on the border.

Locality. Grenville and Fitzroy Harbor, Canada. Types in the museum of the Canadian Geological Survey, Ottawa, Canada.

Genus *BATHYURELLUS* Billings.

Bathyurellus Billings, 1865, Paleozoic Fossils of Canada, Volume 1, page 262.

The following is Billings' original description of this genus:

“*Generic Characters.* — Trilobites of medium size, oblong, ovate; head, thorax, and pygidium sub-equal; head convex, with the posterior angles sometimes produced backward into spines; glabella conical, usually convex, and without glabellar furrows; eyes lunate; facial suture in front of the eye curving outward, then either straight forwards or curving inwards on approaching the margin, behind the eye running outwards sub-parallel to the neck furrow, and cutting the margin before reaching the outer angle. Thorax distinctly trilobed, about nine segments; pygidium with the axis usually short and not strongly grooved; side lobes with short ribs sometimes indistinctly developed; or broad smooth border all around, which is sometimes concave.

“In Newfoundland we first find this genus in Division F, in rocks which appear to be of the age of the lower part of the Calciferous formation, and it ranges upward to Division P, through a thickness of more than 3000 feet.”

The first species described under this generic diagnosis is *Bathyurellus abruptus*, which may be taken as the type. Although the eyes are situated far back and close to the glabella, it shows its primitive position in the Asaphidæ by the possession of nine segments in the thorax instead of eight.

***Bathyurellus brevispinus* sp. nov.** (Plate 10, figures 13-15.)

Cf. *Bathyurellus formosus* Billings, 1865, Paleozoic Fossils Canada, Volume 1, page 265, figure 250.

The material on which this species is founded consists of one cephalon, from which the eyes have been broken, and a single nearly complete cranidium.

DESCRIPTION.

Cephalon very strongly convex, the highest point at the neck segment. Glabella moderately convex and smooth. Its greatest width is between the eyes and it tapers a little both backward and forward. In front it becomes gradually less convex, sloping easily down to the cheeks. Glabella entirely smooth, without furrows. Neck segment wide on glabella, but narrower at the sides. Eyes broken, but the eye lobes show them to be large, lunate, and *Asaphus* like. In front of each is a shallow groove extending to the glabella.

Free cheeks large, extended into short, blunt spines posteriorly. Around the whole margin of the cephalon is a narrow, concave border. The following measurements are taken from the two specimens. The cephalon: length, 15.5 mm.; width, 14.5 mm.; length glabella, 8 mm.; width glabella, 4.5 mm. The cranium: length, 8 mm.; length glabella, 5.5 mm.; width glabella, 3 mm.

The nearest relative of this species is *Bathyuirellus formosus* Billings which was described from Division P, Cow Head, Newfoundland. *Bathyuirellus brevispinus* differs from that species principally in the length of the genal spines and in the convexity of the glabella. In our species the glabella is depressed in front, but in the Newfoundland form it is strongly convex.

Locality.—Found in the pure dolomite layers in the reef three miles southeast of Chazy, New York, near the Lake Champlain shore. Both of the figured specimens are in the writer's collection.

***Bathyuirellus minor* sp. nov.** (Plate 10, figure 16.)

Bathyuirellus validus Raymond, Bulletin American Paleontology, Volume III, No. 14, faunal list, page 301.

In the trilobite layers at Sloop Bay, on Valcour Island, and in some layers of the Crown Point section, small pygidia of a species of *Bathyuirellus* are quite common. The specimens are fairly uniform in size and are all too small to belong to the species just described. No cephalons have been found associated with them, but as these pygidia are not at all uncommon in the localities mentioned, the cephalons will probably be found in time.

DESCRIPTION.

Cephalon and thorax unknown.

Pygidium.—Outline almost semicircular. Axis convex, showing

from two to five annulations. It extends two thirds the length of the pygidium. Sides of the axis nearly parallel and the posterior end abruptly rounded. Entire surface outside the axis concave and smooth.

Measurements. — One specimen is 6 mm. wide, 3 mm. long, axis 2 mm. long, 2 mm. wide on anterior margin.

Another pygidium: width 4 mm.; length 2.5 mm.; axis 1.5 mm. long, 1.25 mm. wide on anterior margin.

Locality. — The specimen figured is from B13, near the middle of the Chazy at Crown Point, New York. It is in the private collection of the writer. The species occurs at several localities on Valcour Island.

Genus *ASAPHUS* Brongniart.

Asaphus marginalis Hall. (Plate 10, figures 17–20, plate 11.)

Asaphus marginalis Hall, 1847, Paleontology of New York, Volume 1, page 24, plate 4 bis, figure 15.

Asaphus marginalis Emmons, 1855, American Geology, Volume 1, part 2, page 235, plate 3, figure 16.

Hall's original description of this species is as follows:

“*Asaphus marginalis* (n. sp.) Caudal extremity semi-elliptical, distinctly three lobed, marked by seven or eight distinct pseudo-articulations, which are duplicate on the lateral lobes; articulations not reaching the margin, but terminating in a crustaceous marginal expansion which is depressed or channelled near the edge as in *Isotelus*; surface granulated.

“This is a very distinctly marked fragment of an undescribed trilobite, the distinctness of the false articulations and the deeply trilobate character of the caudal extremity, distinguish it from the known species of *Isotelus*, which it resembles in the marginal expansion and general form.”

The figure which accompanies this description shows a pygidium with a narrow, raised axis and distinct ribs on the pleura, and these are the characteristics of the pygidia which are here identified with Hall's species. They are nearly all from one locality, the trilobite layers in Sloop Bay, Valcour Island, and associated with them are cephalons of a type very rare among the American Asaphidae. The specimens figured on plate 10 are all small, but the collection in the Carnegie Museum contains about half of the cranidium of an individual, which must have been at least twelve inches long and seven or eight inches

broad, when entire. Fragments of specimens five or six inches long are not at all uncommon. *Asaphus marginalis* has been considered by some, especially the Canadian paleontologists, to be the same as *Asaphus canadensis* Chapman, but now that we are in a position to illustrate Hall's species more fully, several differences will appear.

In the locality mentioned head and abdomen shields are common, but no complete specimen nor any considerable portion of the thorax has yet been found.

DESCRIPTION.

Cephalon broad, not very convex, with a broad concave border all around. Cranidium wide in front, the fixed cheeks small and the eyes close to the glabella. Glabella elongate oval, gently convex, distinctly outlined. There are four pairs of shallow glabellar furrows. The first two pairs are rather indistinct, broad, and are nearly perpendicular to the axis. The third and fourth pairs are deeper, with a diagonal course, and the last pair curve round at the ends, forming two almost isolated lobes near the posterior edge of the glabella. The neck furrow is deep and prominent on the cheeks, but is hardly visible on the glabella. On the median line, opposite the anterior ends of the last pair of glabellar furrows, there is a small spine. From the front of the glabella a ridge runs forward across the concave border, and forms a small triangular projection of the margin. It sends off a lateral ridge along the front for a short distance on each side. In front of each eye is a smooth ridge which runs obliquely forward to the glabella, meeting it at about the place of origin of the second pair of glabellar furrows.

The eyes are relatively small, situated far back and close to the glabella. The free cheeks are large, the genal angles extended as broad, smooth spines. A concentric furrow and ridge start just outside the fixed cheeks and run forward, a little outside the base of the eye, meeting the glabella ahead of the first pair of glabellar furrows.

Surface finely granulose.

A small cranidium, 4 mm. long, from Chazy, New York, shows that in the young stages the glabella is very strongly outlined. The four pairs of glabellar furrows are very distinct, and the neck segment shows on the glabella, although the posterior pair of glabellar furrows are so close to it as to obscure it somewhat.

Thorax unknown.

Pygidium strongly ribbed, moderately convex, with wide, almost

smooth, depressed border. The posterior end of one perfect pygidium is prolonged into two short flat lobes.¹ Whether this is due to accidental causes, a pathologic condition of the individual, or whether it is the normal form, the material at hand is not sufficient to indicate. Axis very narrow and convex, ending abruptly at the border. It shows ten or twelve distinct annulations and sometimes more faint ones can be made out. The pleura show about the same number of narrow, distinct ribs, which are very strongly outlined on the convex portion of the pygidium, but become faint on the border.

Surface minutely granulose.

Measurements. — A cranium: length 22.5 mm.; width at ends of fixed cheeks 28 mm.; length glabella 16 mm. A small cranium: length 4 mm.; width at ends of fixed cheeks 3.5 mm. Glabella 3 mm. long. A large cranium: length 100 mm.; width of front 130 mm.; length of glabella 68 mm. A large pygidium: length 78 mm., width 58 mm.; axis 40 mm. long, 10 mm. wide at the front.

This fine species should be compared very carefully with *Asaphus tyrannus* Murchison, as it agrees with it in many particulars of both cephalon and pygidium. The glabella, glabellar furrows, shape of cranium and presence of a glabellar spine are the same in both species. *Asaphus tyrannus* is one of the typical Llandeilo species, and does not seem to occur outside the typical region in South Wales.

Locality. — Most of the specimens are from the trilobite layers on the east side of Valcour Island, but one cranium was found in the reef at Smuggler's Bay, and another at McCullough's Sugar Bush, Chazy, New York. The specimen figured on plate 10, figure 20, was loaned by Erastus M. Hudson, who found it on the east side of Valcour Island.

Asaphus, species alpha, beta, and gamma. (Plate 12, figures 8–10.)

On plate 12, figures 8–10, are shown the pygidia of three species of trilobites, all of which are very small, mostly less than an eighth of an inch long. Although they cannot now be assigned to any of the species here described, they may be the young of some of them. It is an interesting fact that, although species *alpha* and *beta* occur abundantly

¹ These lobes have been represented on plate 10 as more pointed than the specimen shows them. Two more specimens worked out recently show this same condition, and the outline of the lobes is more nearly as in the reconstructed figure on plate 11.

over a wide geographical range and through a considerable thickness of rock, they do not occur with any of the larger individuals in such a way as to suggest that they are the young of any particular species. Owing to the wide distribution, it becomes necessary to have some way of designating them, and they may therefore be called species *alpha*, *beta* and *gamma*. The third of these little trilobites is a single specimen and is introduced merely on account of its unique form.

DESCRIPTIONS

Asaphus, species **alpha**. (Plate 12, figure 8.)

Pygidium very small, probably representing an immature stage. Axis very convex, and extends back onto the border. There are six to ten annulations on the axis, the annulations being distinct to the posterior end. The pleura show five ribs on each side, each rib bearing a deeply impressed line. Border narrow and smooth.

Measurements. — A pygidium: length 1.25 mm.; width 1.5 mm.; width of axis .5 mm. A larger one is 2.5 mm. long, 4 mm. wide and the axis is 1 mm. wide.

Locality. — Especially numerous in the lower part of the Chazy at the south end of Valcour Island. Found also at Crown Point, Valcour and Plattsburgh, New York.

Asaphus, species **beta**. (Plate 12, figure 9.)

Pygidium broadly rounded, with a narrow, depressed border. Axis high, extending back to the border. Faint annulations are observable on the axis and there are traces of ribs on the pleura.

Measurements. — A fair-sized pygidium is 4 mm. long, 7.5 mm. wide; the axis is 3.25 mm. long and 2 mm. wide on the anterior margin. Another pygidium: length 3.25 mm.; width 5 mm.

Locality. — Most numerous in the middle layers at Crown Point. Found also at various localities on Valcour Island, Plattsburgh and Chazy, New York.

Asaphus? species **gamma**. (Plate 12, figure 10.)

Pygidium very broad, with high, annulated, and very narrow, axis, but no border. The axis extends well back, but not so far as in species *alpha*. There are about six annulations on the axis and five pairs of ungrooved ribs on the pleura.

Measurements. — Pygidium 1 mm. long, 2.5 mm. wide. Axis .75 mm. long, .25 mm. wide at the anterior margin.

Locality. — The specimen is from the south end of Valcour Island just east of the pebble beach. The specimens from which the last three descriptions were drawn are in the writer's collection.

Subgenus *ISOTELUS* DeKay.

Isotelus harrisi sp. nov. ⁷ (Plate 12, figures 3-7.)

Cf. *Isotelus canalis* Hall, 1847, Palaeontology, New York, volume 1, page 25, plate 4 bis, figures 17, 18, 19.

A large *Asaphus*, typical of DeKay's subgenus *Isotelus* is of fairly common occurrence throughout the Chazy, and it has been variously identified as *Asaphus gigas* DeKay, *Asaphus canalis* Conrad and *Asaphus canalis* Billings. Separate pygidia are not easily distinguished from the pygidia of *Isotelus gigas*, but the cephalon is much more depressed than is usual in that species, and all the Chazy specimens, even those six to nine inches long, show a strong genal spine. This would make it fall in with *Isotelus maximus* Locke, but, as has already been pointed out by Clarke, that species may represent only a phase in the development of *Isotelus gigas*. It seems probable that the Chazy form is a distinct species, ancestral to *Isotelus gigas*, showing its more primitive position in the phylogeny of the race by its retention of the genal spines as an adult character.

With *Asaphus canalis*, as defined by Whitfield, the present species does not agree, the pygidia being very different in the two species. The hypostoma figured on page 270, figure 255, of the Paleozoic Fossils of Canada as that of *Asaphus canalis*? somewhat resembles the hypostoma of our species, but the specimen figured on page 352, figure 340, of the same work, is evidently very different both from our species and from *Asaphus canalis* Whitfield.

The species identified by Clarke in the Paleontology of Minnesota, volume 3, part 2, page 707, figure 9, as *Asaphus canalis*? Whitfield also differs from the Chazy species and from Whitfield's Fort Cassin specimens. Since Conrad's specific description was never published, and the specimens figured by Hall under that name were so fragmentary as to be indeterminable, Whitfield is the first to describe and figure a specimen definitely as *Asaphus canalis*. *Asaphus canalis* Whitfield, is so far as known, confined to the Beekmantown formation and probably to the Champlain Valley, where it may be collected at Fort Cassin, Fort Ticonderoga, and Crown Point.

DESCRIPTION.

Cephalon large, smooth, depressed, with a nearly flat border around the front. Eyes large, situated rather far apart and about one quarter the length of the cephalon from the posterior margin. Cranium shows no trace of glabellar furrows. Free cheeks large, bearing a genal spine of varying length, usually not over an inch long on a cephalon three inches in length — measured along the axis of the cranium.

Thorax unknown.

Pygidium rounded in outline, regularly convex, with a somewhat depressed border. Axis barely outlined except at the front. Ribs obscure, visible only in oblique light and best seen on the cast.

Length of cranium 66 mm., width between eyes 60 mm., back of eye 18 mm. from the posterior margin. A pygidium is 79 mm. long, 86 mm. wide, axis 40 mm. wide at the anterior margin.

Locality. — The figured specimens are from the east side of Valcour Island. The species is found at Crown Point, Valcour Island, Chazy and Cooperville, New York.

Isotelus obtusum Hall. (Plate 12, figures 1, 2.)

Asaphus ? obtusus Hall, 1847, Paleontology, New York, volume 1, page 24, plate 4 bis, figure 14.

This species is one of the most common and most characteristic of the Chazy fossils, immense numbers of abdomen shields occurring in certain layers. The specimens are remarkably uniform in size, all the pygidia indicating specimens of about the same length as our single complete specimen, two and one half inches.

DESCRIPTION.

Cephalon short and wide, the genal angles rounded. Glabella smooth, with no trace of glabellar furrows. Eyes large, situated far apart, and near the neck ring.

Thorax of eight segments, the axis wide and the segments turned down quite sharply at the sides. Along each side of the axis are a series of pits between the segments.

Pygidium nearly semicircular, moderately convex, with no border. The axis is faintly developed and there are no ribs on the pleura. Entire surface of cephalon, thorax and pygidium thickly covered with large punctæ, by which character the species can usually be distin-

guished. The following measurements give the proportions of the various parts.

An entire specimen: length 57 mm.; width at the genal angles 31 mm. Length of cephalon 16 mm., width between eyes 16 mm. Length of thorax 20.5 mm., width of axis 12 mm.

An abdomen shield and part of thorax: width of thorax at posterior end 26 mm.; width of axis 12 mm.; length of pygidium 17 mm.; width 25 mm.

Three pygidia have the following dimensions. 1. Length 26 mm., width 40 mm. 2. Length 19 mm., width 28 mm. 3. Length 5.5 mm., width 8.5 mm.

Locality. — The entire specimen is from Smugglers Bay, Valcour Island, and the pygidium and partial thorax from the lake shore of Valcour, New York. The species occurs abundantly at Crown Point, Valcour Island, Plattsburgh and Chazy, New York.

***Isotelus angusticaudum* sp. nov.** (Plate 13, figures 3, 4.)

This is a form but rarely met with, although there are several specimens in this collection and also a number in the collections of the United States National Museum. Only pygidia have been found, but they are very different from the pygidia of any of the other species which occur in the Chazy.

DESCRIPTION.

Cephalon and thorax unknown.

Pygidium narrow, strongly and uniformly convex, tapering rapidly. Sides nearly straight, the margin slightly concave and very steep, axis not strongly marked, wide and low. There are no traces of annulations on the axis nor of ribs on the pleura.

One specimen is 18 mm. long and 19 mm. wide; a second 27 mm. long and 27 mm. wide; a third, 35 mm. long and 36 mm. wide.

Locality. — The type specimen is in the writer's collection and is from the north end of Valcour Island. The species is also found on the east side of Valcour Island, at Chazy, and Isle La Motte, Vt.

***Isotelus? bearsi* sp. nov.** (Plate 10, figures 21-25.)

Along with *Asaphus marginalis* occurs another *Asaphus* of a type not common in America. This is a species with protruding eyes, much resembling the *Asaphus Kowalewskii* of the Lower Silurian of Russia, but not of so extreme a type. As usual the material consists of cranidia,

free cheeks, and pygidia, specimens of all of which are quite abundant at the Sloop Bay locality on Valcour Island.

DESCRIPTION.

Cephalon broad, smooth, flattened on top, with abruptly rounded slopes. Cranidium smooth, flattened, marked by two deep dorsal furrows as in *Illænus*. These furrows start back of the eyes, run inward, and around close to the base of the eye stalks, then outward again to the margin. Indistinct glabellar furrows can sometimes be seen, and on casts of young individuals are four pairs of faint depressions.

Eyes large, raised high above the surface of the head on stalks. Free cheeks relatively small, nearly reaching each other around the front of the head by long spiniform projections. Genal angles rounded. Around the margin of the free cheeks is an extremely narrow striate border.

Thorax unknown.

Pygidium almost semicircular, very evenly convex, with the axis only faintly indicated. There are slight traces of ribs on the pleura and a flattened border extends all around. This pygidium somewhat resembles that of *Isotelus obtusus* Hall, but it may be distinguished from that species by the absence of punctæ, the presence of a depressed border, and by the entire frontal margin.

Measurements. — A cranidium: length 15 mm.; width between tips of free cheeks 22 mm.; between bases of eyes 8.5 mm. Another cranidium is 21 mm. long. The eyes stand 5 mm. above the surface of the cranidium or a total height of 12 mm. above the lateral margin of the cephalon. One pygidium is 11 mm. long and 16 mm. wide, while another is 21 × 27 mm.

This species is closely allied to *Asaphus scutalis* from Caradoc, which Salter referred with some doubt to the section *Cryptonymus* Eichwald. Both cephalon and pygidium of our species differ from *Asaphus expansus*, the type of *Cryptonymus*, but the cephalon also differs much from the typical *Isotelus* in its stalked eyes, deflected front and deep dorsal furrows. The cranidium considerably resembles that of the genus *Illænurus*, but the eyes are much more elevated, the free cheeks narrower, and the anterior ends of the facial sutures much nearer together.

Locality. — Found only in the trilobite layers in Sloop Bay, Valcour Island, New York, in the middle of the Chazy.

Genus *ILLÆNUS* Dalman.***Illænus indeterminatus* Walcott.** (Plate 13, figures 1, 2.)

Illænus indeterminatus Walcott, 1877, Advance Sheets, 31st Annual Report New York State Museum Natural History, page 19.

Illænus indeterminatus Walcott, 1879, Thirty-first Annual Report New York State Museum Natural History, page 70.

Illænus, cf. *I. indeterminatus* Clarke, 1897, Paleontology of Minnesota, volume III, part II, page 716, figure 34.

A couple of large, but slightly imperfect cranidia, and two fairly well preserved free cheeks of this trilobite have been found on Valcour Island. The well developed dorsal furrows and strongly striate anterior margin, with the large size, serve well to characterize this species.

DESCRIPTION.

Cephalon more than twice as wide as long, the free cheeks extended as broad genal spines. Surface only moderately convex, sloping gradually to the front. The dorsal furrows start back of the eyes on the fixed cheeks, run inward and almost parallel to the posterior margin for a short distance, then turn forward, and, after passing the middle of the length of the cranidium, turn outward, reaching to the striate portion of the convex margin. Eyes very large and depressed, situated far apart and some distance from the margin. Free cheeks large, extending back of the posterior margin of the cranidium as broad genal spines. The whole border is marked by four or five deep furrows which start at the sides and extend around the front.

Thorax and pygidium unknown.

Measurements.—A cranidium: length 53 mm.; width 78 mm.; width between eyes 74 mm. A smaller cranidium: length 36 mm.; width 52 mm.

Locality.—This species has been found so far in only one locality, the reef material at Smugglers Bay, Valcour Island. The species has been found in the Trenton at Janesville, and Platteville, Wisconsin, and in the Black River in Herkimer County, New York.

***Illænus punctatus* sp. nov.** (Plate 13, figure 10.)

A rare trilobite in the Chazy is a small *Illænus* with an extremely punctate and wrinkled surface. Of this species the collections afford one whole specimen, four cranidia and one pygidium, but the surface is so characteristic that no confusion should arise from a description of this small amount of material.

DESCRIPTION.

Cephalon. — Cranium small, regularly rounded and abrupt in front. Dorsal furrows short and faint, turning out slightly at the anterior end. Eyes small, situated well back and far apart. Surface very punctate with the exception of two small spots between the anterior ends of the dorsal furrows and the eyes. These are smooth. The front slope is covered with fine concentric wrinkles, between which are rows of punctæ.

Thorax of nine segments which are very narrow and turn down and a little backward at the sides, but are straight and flat on the dorsal region of the pleura. Axis strongly convex and about one third the width of the thorax. It tapers very gradually, and in our specimen is 4.5 mm. wide at the front end of the thorax, and 4 mm. wide at the pygidium, thus losing only .5 mm. in a length of 6.75 mm. Surface punctate.

Pygidium almost semicircular, gently convex. Axis is defined for a short distance, but is not prominent. Surface covered with very numerous shallow punctæ.

In the complete specimen the pygidium is drawn up at right angles to the axis of the body so that it is hardly visible from the dorsal aspect. It can not be determined from our material whether this is the natural position, or whether it may be due to crushing. The cephalon is distorted, making one eye appear much more prominent than it should, while the other is removed. The entire specimen is 14 mm. long and 12 mm. wide at the genal angles. The cephalon is 7.5 mm. long and the thorax and pygidium, if flat instead of being drawn up, would make the total length 19 mm.

Locality. — The type specimen, which is in the collection of the writer, is from the middle of the Crown Point section. Other specimens have been found in the upper layers on Valcour Island.

***Illænus bayfieldi* Billings.** (Plate 13, figures 11, 12.)

Illænus Bayfieldi Billings, 1859, Canadian Naturalist and Geologist, volume IV, page 369, figures 4-6.

This is the only one of the seven species of trilobites described by Billings from the Chazy limestone at the Mingan Islands which has not yet been found in the Champlain Valley. Professor Whiteaves very kindly loaned two of the typical specimens, figures of one of

which are produced in our plates. A reëxamination of the specimens shows nothing which escaped the acute eye of Mr. Billings, therefore his original description is given *in toto*.

“*Illænus Bayfieldi* (n. s.).

“DESCRIPTION.

“Oblong, distinctly trilobed; length two or three inches, width three fourths the length, central lobe rather more than one third the whole width. Proportional length of head, thorax and pygidium about as 9, 8, $6\frac{1}{2}$. The head is transversely oval in outline, the width twice the length, rather evenly convex, most prominent in the center, the front margin broadly rounded, the posterior margin trilobed by the dorsal furrows which are extended forward to about the middle of the head, but are distinct for only about one fourth that distance; they at first incline towards each other and then becoming very obscure, curve outwards; on each side of the central lobe the posterior margin is nearly straight, as far as the eye, when it gradually curves forward and outward for one half the length of the head, then turning a broad rounded angle, it merges into the front margin.

“In consequence of the peculiar form of the posterior margin, the genal angle, in this species, is in the front half of the lateral margin of the head. The eye is of moderate size, lunate and within one fourth its length from the margin. The facial suture curves forward so as to cut the front margin considerably within a longitudinal line drawn through the eye: behind the eye its course is remarkable, as it turns outward and runs parallel with the margin, which it reaches at about three fourths the length of the pleura. The lower angle of the eye is distant from the dorsal furrow a little less than half the width of the central lobe of the posterior margin. The width of the cheek piece on a line drawn transversely across the head at one third the distance from the eye to the front is nearly equal to half the distance between the eyes. In a vertical view of the head, neither the full width of the cheek piece nor the position of the genal angle can be seen, as the outline is fore-shortened, consequently in the figure above given, the width appears less than it really is.

“Thorax of ten articulations, axis of thorax square, the length and breadth being the same, moderately convex, well defined; the fulcra of the pleura are at about one third the width of the axis from the dorsal furrow, the intervening space flat.

“Anterior edge of the pygidium convex at the axial lobe, obliquely truncated from the fulcrum, the axis either not at all or very obscurely defined.

“Surface smooth, with the exception of the front of the head, where there are, at the margin, the usual transverse fissures.

“This species was discovered by Admiral Bayfield, R. N., during his survey of the Gulf of St. Lawrence. A well preserved specimen is in the Cabinet of the Geological Society of London among the fossils presented by Admiral Bayfield. During the present year, 1859, Sir W. E. Logan visited the Mingan Islands and procured numerous specimens at Trilobite Bay, the original locality.

“Dedicated to the discoverer, Admiral Bayfield.

“*Locality and Formation.*—Trilobite Bay, Mingan Islands, Chazy.” Type in Ottawa Museum.

***Illænus globosus* Billings. (Plate 13, figures 6, 7.)**

Illænus globosus Billings, 1859, Canadian Naturalist and Geologist, volume IV, page 367, figures 1-3.

This little species is very common in the Chazy of the northern part of the Champlain Valley, especially in the reef material where there are pockets which consist almost entirely of the separated head and abdomen shields of this one trilobite. The axis of the thorax is very wide and the pygidium smooth and undifferentiated like *Bumastus*. The head, however, shows fairly strong, though short dorsal furrows, and the furrows on the thorax, while very far apart, are deeply impressed.

DESCRIPTION.

Cephalon short, broadly rounded, and steeply convex toward the front and at the sides. Frontal margins striate and incurved. Dorsal furrows short, directed obliquely inward, with a slight outward curve at the anterior end. Eyes small, far back, and very far apart. Free cheeks also small, steeply sloping. Genal angles rounded, extending a little back of the posterior margin of the cranium. Shell smooth, not punctate. Thorax of ten segments. Axis very wide, dorsal furrows deep, and paralleled by ridges, in passing over which the segments turn forward and then backward.

Sides steep and the ends of the segments directed backward. Pygidium regularly rounded, very convex, without any trace of the axis except at the anterior margin. The whole trilobite is oblong, tapering only a little.

Measurements.—A thorax and pygidium: length of thorax, 12 mm.; pygidium, 13 mm. Width of thorax at anterior end, 21 mm. Width of axis, 15 mm. Width of pygidium, 19 mm.

A cephalon: length 10 mm.; width 14 mm. Width between eyes 11.5 mm. Distance of back of eyes from posterior margin, 1 mm.

Another cephalon: length 30 mm.; width of cranidium, 44 mm.

Another is 18 mm. long, cranidium, 22 mm. wide.

Locality.—Very common at Chazy, Valcour Island, Plattsburgh and Crown Point, New York.

***Illænus erastusi* sp. nov.** (Plate 13, figures 8–9.)

Illænus crassicauda? Hall, 1847, Paleontology of New York, volume 1, page 24, plate 4 bis, figure 13. Not *Illænus crassicauda* Hall, 1847, Paleontology of New York, volume 1, page 229, plate 60, figures 4a–d.

Under the name *Illænus crassicauda*? Hall figured a portion of the cephalon of a comparatively large *Illænus* from the Chazy. Specimens answering to these figures and the description are not uncommon, but as they do not belong to the species *Illænus crassicauda* Wahlenburg, it becomes necessary to propose a new specific name. The species is not the same as the one figured by Hall on plate 60, figures 4c and d of the first volume of the New York Paleontology, nor does it agree with *Illænus americanus* Billings, as Clarke considers this second *Illænus crassicauda* to do.

All the specimens in our collection are of separated head and abdomen shields. No complete specimens have, as yet, been found.

DESCRIPTION.

Cephalon large, nearly semicircular, the genal angles obtusely rounded but extending somewhat behind the posterior margin of the glabella. Glabella smooth, not differentiated. Dorsal furrows far apart, joining the neck furrows, which are visible only back of the eyes. The dorsal furrows run forward and approximately parallel, for a short distance, then turn outward and fade out after reaching three quarters of the distance to the anterior margin. In the course of each, about half way between its anterior end and the margin, is a small pit, and to this pit the dorsal furrow is connected by an almost imperceptible depression in the surface.

The eyes are large, situated well to the sides and far back. Free cheeks large, extending a little back of the posterior margin of the

cranidium, bearing no spines, but having a very narrow convex border. The anterior border of the cephalon is striate or wrinkled for some distance back from the anterior margin and thickly sprinkled with fine punctæ.

Thorax unknown.

Pygidium. — Pygidium larger than the cephalon, uniformly convex, the only trace of the axis being on the anterior margin. Surface covered by very fine punctæ.

Measurements. — A cephalon; length 21 mm.; width 40 mm. Length of furrows, 14 mm., width between posterior ends of furrows 18 mm. Width between eyes, 24 mm.

Cranidium: length 29 mm.; width 36 mm.; furrows 18 mm. long.

A pygidium: length 29 mm.; width 30 mm.

Another: length 34 mm., width 37 mm.

Locality. — Type specimens from Smuggler's Bay, Valcour Island. The species is also found at Valcour and Chazy, New York.

Subgenus *THALEOPS* Conrad.

***Thaleops ovata* Conrad. (Plate 13, figure 5.)**

Thaleops ovata Conrad, 1843, Proceedings of the Academy of Natural Science, Philadelphia, volume 1, page 332.

Thaleops (Illeenus) ovatus Hall, 1847, Paleontology of New York, volume 1, page 259, plate 67, figures 6 *a, b*.

Illeenus arcturus Hall, 1847, Paleontology of New York, volume 1, page 23, plate 4 bis, figure 12.

Illeenus arcturus Emmons, 1855, American Geology, volume 1, part 2, page 235, plate 3, figure 12.

Illeenus clavifrons Billings, 1859, Canadian Naturalist and Geologist, volume IV, page 379.

Illeenus arcturus Billings, 1859, Canadian Naturalist and Geologist, volume IV, page 379.

Illeenus vindex Billings, 1865, Paleozoic Fossils Canada, volume 1, page 179, figure 160.

Illeenus ovatus Whitfield, 1882, Geology of Wisconsin, volume IV, page 238, plate 5, figures 1-2.

Illeenus herricki Foerste, 1887, 15th Annual Report of the Geological and Natural History Survey of Minnesota, page 479, figure 2.

Thaleops ovatus Clarke, 1897, Paleontology of Minnesota, volume III, part 2, page 716, figures 25-28.

Illeenus ovatus Raymond, 1902, Bulletin American Paleontology, volume 3, number 14, plate 18, figure 9.

After a careful study of a large amount of material the writer is

unable to find any important differences between the Chazy trilobite known as *Illænus arcturus* and the common *Thaleops ovata* Conrad of the Trenton. *Illænus vindex* Billings (fig. 2) and *I. clavifrons* Billings are also evidently the same as the Trenton species just mentioned and thus all the individuals of the *Thaleops* type found in the Chazy seem to belong to the one species.



FIG. 2. Dorsal and anterior view of *Illænus vindex* Billings. Reproduced from Billings' figures in Paleozoic Fossils of Canada, volume I.

The cranidia and pygidia are found everywhere and may easily be recognized, the cranidium by its deep furrows and spine like eye lobes, and the pygidium by its sharply outlined axis.

DESCRIPTION.

Whole animal short and wide. Both cephalon and pygidium very broadly rounded.

Cephalon very broad, abruptly deflected in front with the free cheeks produced into long lateral spines.

Glabella outlined by broad deep furrows which run about parallel from the posterior margin half way to the front, then turn outward and downward over the front of the cephalon. These dorsal furrows are especially deep and strong on the cast. On the front of the horizontal part of the glabella are two slight elevations outlined by indistinct furrows, indicating the position of the first pair of glabellar furrows. Neck furrow visible on the cast, but only seldom seen on the test. Fixed cheeks moderately convex. Eyes rather small, situated high on stalks which extend outward and upward at an angle of about 45° . Free cheeks drawn out into long narrow spines. All around the front is a very narrow striate margin. Surface punctate.

Thorax of ten narrow segments which run nearly straight across the body, turning downward and backward on the sides. Axis about one third the width of the dorsal surface and only moderately convex, while the pleura are nearly flat. Segments sparsely marked with punctæ which are arranged in straight lines across the thorax, one or two rows to a segment. They are more noticeable on the first two or three segments than on the ones further back.

Pygidium. — Pygidium short and wide, gently rounded posteriorly. Axis high, extending about half way to the posterior end and outlined all around by a deep furrow. On the cast the posterior end of the axis is faintly bilobed, and back of it is a shallow groove extending over the posterior slope to the margin. On one specimen the cast shows a ridge in place of this groove. Surface covered with shallow punctæ.

Measurements. — Whole specimen: length 30 mm.; greatest width at outside of tip of free cheek spines, 41 mm. Width front end of thorax, 26 mm. Width of front of glabella 12 mm. Glabella, at neck ring, 7 mm. wide. Width between eyes, 29 mm. Between bases of eye stalks, 19 mm. Height of front of glabella, 10 mm. Length of thorax 9 mm. Length of cephalon 11 mm. Pygidium 10 mm. long. Width of axis at cephalon, 10 mm. Axis at pygidium 8 mm. wide. Length of axis on pygidium, 5 mm.

A large cranium: width between bases of eyes 31 mm.; length 21 mm. Width of glabella: 12 mm. at neck ring; 17 mm. in front.

Another pygidium: width at front, 23 mm.; greatest width, 27 mm.; length, 16.5 mm.; axis 8 mm. long.

Locality. — Figured specimen from middle of Crown Point section. It is now in the Cornell University Museum. The species is very common at Crown Point, Valcour, Valcour Island, Chazy, New York, and Isle La Motte, Vermont.

Family PROËTIDÆ Barrande.

Genus *PROËTUS* Steininger.

***Proëtus clelandi* sp. nov.** (Plate 13, figures 13, 14.)

In the Jewett collection, now in the Cornell University Museum, are two small specimens labeled *Sphærexochus*? which are evidently a species of *Proëtus*. The specimens are two cranidia in a coarse reddish limestone, but the matrix contains no evidence by which it can be told from what horizon of the Chazy it was derived.

DESCRIPTION.

Cephalon. — Glabella strongly convex, abrupt in front and at the sides. There are two pairs of very faint glabellar furrows, the posterior pair a little longer and deeper than the anterior pair. Margin in front of the glabella narrow and concave. Neck segment narrow and convex, with a deep furrow separating it from the glabella. There is

a small tubercle on the middle of the ring. Eye lobes small, and far back. Free cheeks missing.

The following are the measurements of the best specimen. Cranium: length 10.5 mm.; width between eyes, 8 mm.; length of glabella, 8 mm.; width of concave border, 2 mm.

This species differs from *Proetus parviusculus* Hall by showing glabellar furrows and in the presence of a tubercle in the neck ring. The general shape of the glabella is about the same. It somewhat resembles *Proetus latimarginatus* Weller from the Trenton of New Jersey, but the glabellar furrows are not so deep and it has only two instead of three pairs.

Locality.—In a coarse reddish limestone at Chazy, New York. Type specimens in the Cornell University Museum, catalogue number 5768.

Family LICHADIDÆ Barrande.

Genus *LICHAS* Dalman.

Subgenus *PLATYMETOPUS* Angelin.

***Platymetopus minganensis* Billings.** (Plate 14, figures 1-3.)

Lichas Minganensis Billings, 1865, Paleozoic Fossils Canada, volume 1, page 181, figure 163a-b.

Lichas Champlainensis Whitfield, 1881, Bulletin American Museum Natural History, volume 1, number 8, page 342, plate 33, figures 6-8.

In the absence of a complete specimen of either of the above species, it may seem unwarranted to put the two together, but there seems to be sufficient evidence that there is but one species commonly met with in the Chazy, and, as all the cephalons collected belong to Billings' species and all the pygidia to Whitfield's *Lichas champlainensis*, there seems to be a strong probability that the two are one species.

Billings, in 1865, described the glabella of a *Lichas* from the Chazy or Black River limestone of Large Island in the Mingan Islands. Whitfield, in 1881, described a pygidium from the Birdseye limestone (now known to be dolomite layers of the Chazy) at Isle La Motte, Vermont. The glabellæ are very commonly met with at Valcour Island, Chazy and elsewhere, and, although there is some variation, due to the state of preservation, all can be readily referred to *L. minganensis*. Pygidia are not so common and there is more variation, but there are specimens from the buff-colored layers, at Chazy, which

correspond exactly to Whitfield's figures, and, in this locality, they are associated with glabellæ which correspond with Billings' description of *L. minganensis*.

DESCRIPTION.

Cephalon. — Only the glabella and fixed cheeks are known, the free cheeks and eyes not having, as yet, been found. Whole head quite convex, sharply deflected in front. Median lobe nearly rectangular posteriorly, but expanding rapidly in front. Neck ring nearly flat, quite broad back of the middle lobe, but becoming narrower at the sides. Along the anterior edge is a flat border which is very narrow in front of the middle lobe but becomes wider in front of the side lobes. The entire surface is covered with variously sized pustules.

Thorax. — Unknown.

Pygidium broad and flat, with strongly elevated axial lobe, which is broad at the anterior end, tapers slightly for a short distance, and is then reduced rapidly to a point. The axis always shows two strong annulations and sometimes two faint ones. There are three broad lobes on each side of the axis. They are directed backward and have free terminations. Each lobe has a deeply impressed line which extends back about half its length. These lines are not very conspicuous on the two posterior lobes. Surface entirely covered with small pustules.

The principal variations in the cephalons of this species lie in the width of the middle lobe, which is narrow on some forms and wide on others, and in the size of the pustules on the surface. On some specimens the pustules are fine, even, and inconspicuous, while on others there are large and small ones, making a pretty and showy ornamentation.

The pygidia vary in the number of annulations on the axis, and in the width and convexity of the axis, relative to the rest of the pygidium. In some, the cross section of the axis would be about semi-circular. Others are more flattened and diminish more abruptly posteriorly.

Hypostoma. — The hypostoma found constantly associated with this species is shown on plate 14, figure 3.

Measurements. — A cranium: 20 mm. long; 26 mm. wide.

Middle lobe 7 mm. wide behind; 15.5 mm. wide in front. Second lobes, 7 mm. wide.

Another cranidium: length 15.5 mm.; width 24 mm.; middle lobe 5 mm. wide behind; 13.5 mm. wide in front.

A pygidium: length 8 mm.; width 11.5 mm.; axis 5 mm. long.

Another pygidium: length 16 mm.; width 22 mm.; axis 9 mm. long.

Locality. — Occurs in middle and upper Chazy on Valcour Island, also at Chazy and Cooperville, New York; Isle La Motte, Vermont; Montreal and Mingan Islands, Canada. Figure 1 is from a specimen in the Carnegie Museum. Figures 2 and 3 are from specimens in the writer's collection.

Family ACIDASPIDÆ Barrande.

Genus *ACIDASPIS* Murchison.

Subgenus *GLAPHURUS*¹ (name proposed).

There are, in the Chazy limestone, two species of trilobites which, from their general characters must be placed in or near the genus *Acidaspis*, yet which do not conform to the definitions of any of the subgenera of *Acidaspis* now in use. Clarke, in his "Note on *Acidaspis*," Forty-fourth Annual Report of the New York State Museum, 1892, distributed the American species of *Acidaspis* among several subgenera, all the Ordovician forms going into his division *Odontopleura*. The Chazy forms differ from *Odontopleura*, and, in fact, from all species of *Acidaspis*, in having eleven or twelve segments in the thorax, and a pygidium with an aspinose margin.

According to Hall's figures, *Acidaspis trentonensis* is without spines on the posterior margin of the pygidium, but comparing its structure with the pygidium of *Odontopleura parvula* Walcott and other species it seems probable that, when perfect, the dorsal ridges of the pygidium extended beyond the margin as spines.

The type of this subgenus is *Arionellus pustulatus* Walcott.

***Glaphurus pustulatus* Walcott.** (Plate 14, figures 4-6.)

Arionellus pustulatus Walcott, 1877, Advance Sheets Thirty-first Annual Report New York State Museum Natural History, page 15.

Arionellus pustulatus Walcott, 1879, Thirty-first Annual Report New York State Museum Natural History, page 68.

¹ *Glaphurus*. Derived from the Greek verb γλῆφω, the root of which is used in the noun γλῆφνία, meaning *smoothness*, and the noun οὐρά, meaning a *tail*.

Sao (?) *Lamottensis* Whitfield, 1881, Bulletin American Museum Natural History, volume 1, page 334, plate 33, figures 9-11.

Agraulos (*Arionellus*) *pusulatus* Vodges, 1890, Bibliography of Paleozoic Crustacea from 1698 to 1889. Bulletin United States Geological Survey, number 63.

Although this is a very common species in the buff-colored dolomite of the reefs, it occurs only rarely elsewhere, and seems to have a restricted vertical range. Whole specimens, while not entirely lacking, are rare, and the part usually found is that which Mr. Walcott described in his original description of *Arionellus pusulatus*, namely, the cranidium. These detached cranidia are wonderfully abundant in the reef material on Isle La Motte, at King's Bay, Cooperville, at Chazy and on Valcour Island. All of the whole specimens in this collection are from a small pocket of rather crystalline limestone in a reef about three miles south of Chazy village, New York. The following is Walcott's original description taken from the second paper cited above :

“ ARIONELLUS PUSTULATUS n. sp.

“ Glabella very convex, separated from the fixed cheeks by a strong dorsal furrow : short glabellar furrows outline a frontal lobe on the anterior third ; a lateral lobe is indicated, on each side, by a short depression or furrow parallel to the longitudinal axis of the glabella. Fixed cheeks depressed beneath the level of the glabella. The strong dorsal furrow, extending all around in front of the glabella, and the rapidly sloping outer margin gives them a prominent, rounded, almost tumid appearance. Occipital segment broad, depressed, separated from the glabella by a narrow furrow. One segment of the thorax is preserved in one specimen. It is strongly arched on the axial lobe, pleuræ with an elevated posterior ridge, and depressed anterior margin. Surface pustulose or finely tuberculated. Eyes, movable cheeks, and pygidium unknown.

“ Formation and locality ; Chazy Limestone, Chazy, New York.”

Although no figure accompanies this description, it is evident that the author had in hand a cranidium of the species Whitfield described in 1881 as *Sao* ? *Lamottensis*. Whitfield's description was accompanied by a dorsal and side view of the cranidium and a figure of a thorax showing eleven segments, attached to which is a small pygidium whose details are left rather indefinite.

In the description it is stated that there are twelve segments in the thorax, but the ends of the segments on the pleura are not represented

as bearing spines, nor are any spines mentioned as occurring on the cranium. Professor Whitfield mentions an associated hypostoma, but his material lacked the free cheeks and the details of the pygidium could not be made out. The specimens were, however, very small, the thorax described being only six twentieths of an inch in length. In discussing the generic relations of this species, Whitfield says: "The next nearest genus might be *Acidaspis*. In the structure of the pleura this species differs quite remarkably from *Sao hirsuta*, being between that and *Acidaspis*, having a central ridge which becomes obsolete, however, on the outer portions. Also it differs in the backward bending and pointed structure of their extremities."

Now that specimens have been found which show the spines it becomes evident that this peculiar species is an *Acidaspis*, and one of the most spinose trilobites in the American Ordovician.

DESCRIPTION.

Cephalon broad, roughly semicircular, spinose, cranium large, extending nearly the whole width of the cephalon and terminating anteriorly in a sort of ring-shaped projection on which are five long slim spines which point forward and upward at an angle of about forty-five degrees. Fixed cheeks prominent, convex, sloping rapidly to the sides. Glabella very convex, separated from the fixed cheeks by a deep furrow which extends around the front and makes a little more than half a circle. The anterior pair of glabellar furrows are short and directed a little backward, making only a sort of a dent in the side of the glabella near the front. Back of these furrows there is, on each side, a pit parallel to the axis of the glabella, making two small convex side lobes. Over the fixed cheeks and glabella are scattered spines of different sizes. On the top of the glabella and close to the axis are two rows of large spines, three in each row. On each fixed cheek is a row of large spines parallel to the furrow outlining the glabella. There are three or four spines on each side. Interspersed with these are a large number of smaller spines, all pointing upward and forward.

The neck furrow extends all across the cranium, and the neck segment is narrow and convex. At each lateral angle is a long thin spine which extends out horizontally and turns a little backward.

Free cheeks large, with a narrow, convex, border which bears numerous small spines. At the genal angle the cheek bears a short,

robust backward directed spine. The whole surface of the free cheek is covered with small spines or pustules and between them are minute pits. The eyes are small, situated some distance from the glabella and about opposite the anterior pair of glabellar furrows.

Thorax. — The best specimens in the collection have only eleven segments in the thorax, but all are small, and it is possible that larger individuals would show more segments. Axis very convex, prominent, occupying more than one third of the width. Each segment bears, on each side of the axis, near the dorsal furrows, a node with three small spines, and along the top of the axial lobe are numerous small spines. In removing the matrix from the specimen, the shell is almost always broken from the axis of the thorax and only one specimen shows any other than a smooth condition of the segments along the axial lobe.

The pleura are narrow and flat. The first segment ends in sharp spines which are directed backward, but the succeeding ones seem to be rather rounded on the ends and each bears three nearly horizontal spines, two of them short and one very long.

Along the front of each segment on the pleura is a narrow raised border which becomes stronger toward the sides. On it are upward pointing spines, and at the side of the pleuron it supports two small, nearly horizontal spines. Back of this ridge is a narrow groove, behind which is another ridge which bears numerous large spines which point upward but ends in a large horizontal spine at the side which points a little backward.

Pygidium very small, semicircular; axis prominent, extending to the posterior border. Margin entire, a narrow convex border ornamented with small spines running all around. The axis shows two or three annulations, and behind the last annulation are rows of very small spines which run over the axis parallel to the annulations. Side lobes covered with small spines, and show two to four pairs of faint ribs.

Measurements. — A cranium and six segments: length 19 mm.; length cranium 10 mm.; width 17 mm.; length of glabella 7 mm.; width glabella 7 mm.; eye 5 mm. from posterior margin; 3 mm. from glabella. Length of the large horizontal spine on 5th segment 4 mm.; spine from neck segment 3.5 mm.; a spine on middle of front of cranium 2.5 mm.; a spine on side of cranium 3 mm.

A Small Specimen. — One entire specimen is 4 mm. long and 2.25

mm. wide at the genal angles. With the exception of its incomplete thorax this small specimen has all of the characters of the adult, including spines. It does however show a few adolescent characters.

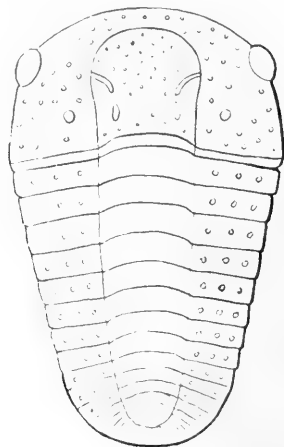


FIG. 3. *Glaphurus pustulatus* Walcott. Outline of a young specimen with eight thoracic segments. Notice the anterior and marginal position of the eyes and the segmentation of the pygidium. Enlarged sixteen diameters.

Cephalon. — The free cheeks are smaller than in the adult and the eyes are situated on the very edge of the cephalon. The glabella is very convex, but the glabellar furrows are the same as in the adult.

Thorax has eight segments.

Pygidium shows seven or eight pairs of ribs on the pleuræ and four or five annulations on the axis. (Figure 3.)

This species differs so widely from all other known species that it can hardly be compared with any particular one. The glabella somewhat resembles that of *Odontopleura parvula* Walcott but the eyes are smaller, much further forward, and the free cheeks much more convex.

Locality. — The species occurs both in the reef material and in the coarsely crystalline limestone which accompanies it at Valcour Island, Sloop Island, Chazy, Cooperville, N. Y., and Isle La Motte, Vt. The figured specimens are in the writer's collection and are all from Chazy, New York.

Glaphurus primus sp. nov. (Plate 14, figures 7, 8.)

Another species of *Glaphurus* with a much more primitive glabella occurs in the lower Chazy at Valcour in the quarries which yielded the specimens of *Cybele valcourensis*. Of this species only the glabella and free cheeks have been found, but they are important, showing, as they do, a primitive condition in the lobation of the *Acidaspis* glabella.

DESCRIPTION.

Cephalon. — Cephalon short, broad, with wide glabella outlined by a narrow but deep furrow. Glabella moderately convex, having on a general view a central lobe which expands toward the front, and two small side lobes. This appearance is caused by three pairs of glabellar furrows, all of which are short and turn backward. The second pair run back into the third pair, and the third pair join the neck furrow. The surface is spinose but has fewer spines than *Glaphurus pustulatus*. The fixed cheeks are very convex. Free cheeks convex, the eye small but prominent. There is a convex spinose border which is separated from the cheek by a narrow furrow and at the genal angle is a large spine. The surface of the cheek is pitted all over except just below and a little in front of the eye where there is a group of small spines.

Thorax and pygidium unknown.

Locality. — This species has been found in the lower layers of the Chazy at Valcour, New York, and in both the lower and upper layers on Valcour Island. The type specimens are in the writer's collection.

Order PROPARIA Beecher.

Family ENCRINURIDÆ Linnarsson.

Genus CYBELE Lovén.

Cybele valcourensis sp. nov. (Plate 14, figure 9.)

Of this species, the fourth of the genus to be found in the Ordovician of America, we have, so far, only the pygidium, and all the specimens — about a dozen — are from the well-known quarries near the road at Valcour, five miles south of Plattsburgh, New York.

DESCRIPTION.

Cephalon and thorax unknown.

Pygidium narrow, tapering almost to a point. Axis narrow, but

very prominent, not extending to the posterior end. The first annulation of the axis extends clear across, and behind it are fifteen to eighteen which show only on the sides. Along the top of the axis are four or five pairs of nodes which are located at equal intervals along its length. There is a single median protuberance at the posterior end of the axis. On the pleura are four pairs of double ribs which turn back nearly parallel to the axis. Each double rib consists of a smaller anterior and larger posterior portion. The ribs end in short rounded spines which extend only a very short distance behind the border and, when these spines are broken, as is often the case, the margin appears as if entire. Up near the axis each rib bears a small node.

Measurements.—Three pygidia :

1. Length 4.5 mm.; width 3.75 mm.; length of axis 3.5 mm.
2. Length 3.75 mm.; width 3 mm.; axis 3 mm. long.
3. Length 6 mm.; width 5 mm.; axis 4.75 mm. long.

From *Cybele* (*Encrinurus*) *mirus* Billings, this species differs in being more slender and in having only one annulation, instead of fourteen, extending across the axis.

To *Cybele winchelli* Clarke, our species is very closely related, but it has evidences of a great many more annulations on the axis than are shown by that species.

The only other American species, so far described, is *Cybele* sp. Ruederman from the Rysedorph conglomerate. Only a fragment of the anterior part of this specimen is known, but it differs from our species in having the posterior annulations extending all across the axis.

The rarity of *Cybele* in American faunas can be most plainly brought out by noting that, so far, one nearly complete specimen has been collected from the Trenton in Minnesota; a fragment of a pygidium from Rysedorph Hill, New York; a few fragments of pygidia from the Quebec group, in Newfoundland, and a dozen pygidia from one locality in the Chazy limestone in New York.

Formation and Locality. — All the specimens are from the quarries near the road at Valcour, New York.

Family CHEIRURIDÆ Salter.

Genus *AMPHION* Pander.

Amphion canadensis Billings. (Plate 14, figures 10–13.)

Cf. *Calymene multicosta* Hall, 1847, Paleontology of New York, volume 1, page 228, plate 60, figure 3.

Amphion Canadensis Billings, 1859, Canadian Naturalist and Geologist, volume IV, page 381, figure 12 a, b.

Amphion Canadensis Billings, 1863, Geology of Canada, page 133, figure 69.

Amphion Canadensis Billings, 1865, Paleozoic Fossils Canada, volume I, page 288, figure 278.

This abundant species, which is the only one of the Chazy trilobites of which entire specimens are at all common, can now be figured and described from very complete material. Most of the whole specimens obtained by the writer have been taken from the rocks immediately south of Tiger Point, on the east side of Valcour Island. In all cases, they were found in pockets of mud which occur with some frequency in an otherwise fairly pure limestone. Another locality, which has furnished very satisfactory specimens, is the point at the southeast end of Valcour Island, where the specimens also occur in muddy layers. Nearly all the specimens are more or less distorted, the distortion occurring at the points which are nearest the limestone and covered by the thinnest coating of the clay. Although these specimens are usually found stretched out in the natural position, an occasional enrolled specimen is found in the same layers. While these localities have furnished the most satisfactory specimens, the matrix in which the species occurs most freely is the pure buff dolomite of the reefs. Those layers about Smuggler's Bay contain vast numbers of whole and fragmentary specimens, which are, however, of little use to the collector as they cannot be extracted without removing a large part or all of the test.

DESCRIPTION.

Cephalon wide, short, rather uniformly convex. Glabella gently convex, broadly rounded in front. There are three pairs of glabellar furrows, the first pair being very close to the anterior margin and not very deeply impressed. They vary in direction on different specimens, sometimes running somewhat forward, while, in other specimens, they are curved backward. The second and third pairs run very nearly perpendicular to the axis and about half way to the center of the glabella. Fixed cheeks large, including the genal angles which are rounded and without spines. Free cheeks small. Eyes prominent, opposite the second glabellar lobes and situated at a distance from the glabella equal to about their own width. The entire cephalon is surrounded by a wide, convex border which is outlined by a deep furrow. Surface granular.

Thorax. — There are nineteen thoracic segments. The axis occupies about one third the width of the thorax and tapers very gradually toward the pygidium. The trilobite is widest at the posterior angles of the cephalon, but tapers only a little posteriorly. The pygidium forms almost a semicircle. On the axis the segments bend forward very considerably, while on the side lobes their course is almost perpendicular to the axis; at the sides they turn backward and curve sharply downward.

Pygidium. — The pygidium is nearly semicircular, convex, steep at the sides and back. Axis of medium width, with six annulations, the last triangular. There are five ribs on each side, extending, as spines, beyond the margin. These spinose terminations are quite close together, the spaces being of less width than the spines.

Measurements. — Largest specimen: length 78 mm.; width back of cephalon, 40 mm.; length of cephalon, 18 mm. Eyes 25 mm. apart; 5 mm. from back of cephalon; 4 mm. from glabella. Thorax 48 mm. long. Axis 14 mm. wide at cephalon; 11 mm. at pygidium. Thorax 29 mm. wide at pygidium.

Second in size: length 38 mm.; width back of cephalon 21 mm. Cephalon 9 mm. long. Thorax 25 mm. long. Axis 8 mm. wide at front; 5 mm. at pygidium. Thorax 15 mm. wide at pygidium. Distance between eyes 13 mm. They are situated 2 mm. from the glabella and 2.5 mm. from the posterior margin.

A small specimen: length 31 mm.; width back of cephalon 18 mm. Eyes 12 mm. apart; 2 mm. from glabella; 1.5 mm. from the posterior edge. Thorax 18.5 mm. long. Axis 6.5 mm. wide at cephalon; 4 mm. wide at pygidium. Length of cephalon, 7 mm. Width at front of pygidium, 6 mm.

Locality. — Valcour, Valcour Island, Chazy and Cooperville, New York; Isle La Motte, Vermont; Montreal and Mingan Islands, Canada. The pygidium figured is from a specimen in the Carnegie Museum.

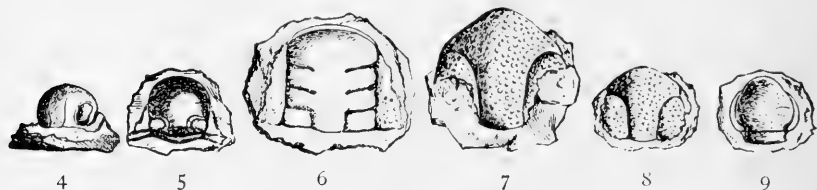
Genus *CERAURUS* Green (sensu stricto).

Ceraurus pompilius Billings. (Plate 14, figure 14.)

Cheirurus Pompilius Billings, 1865, Paleozoic Fossils of Canada, volume I, page 181, figure 162.

The specimen on which this species was founded is so small a fragment that it is with some doubt that we assign our specimens to

Billings' species. This is, however, the only species of *Ceraurus* in our collections with a subrectangular glabella and isolated posterior glabellar lobes. (See figure 6.) Glabellæ of this sort are quite common in the trilobite layers at Sloop Bay, where they accompany the following species, but can always be easily distinguished from it.



FIGS. 4, 5. *Sphaerexochus parvus* Billings.

FIG. 6. *Ceraurus pompilius* Billings.

FIGS. 7, 8. *Platymetopus minganensis* Billings.

FIG. 9. *Remipleurides canadensis* Billings.

Figures 4 to 9 are reproductions of Billings' original figures in Volume One of the Paleozoic Fossils of Canada.

DESCRIPTION.

Glabella subrectangular, broadly rounded in front; moderately convex. Three pairs of glabellar furrows; the first two pairs nearly parallel to the neck furrow, while the last pair turn abruptly back, joining the neck furrow. Neck segment wide, separated from the glabella by a deep furrow. Fixed cheeks wide, triangular and bearing the genal spine, which is very long and slightly bowed. Eye small, situated opposite the third glabellar lobe and about 2 mm. from it. Free cheeks small. Whole surface papillose, the pustules being small and thickly scattered over the glabella and cheeks, but rather sparingly on the margins and spines, where there are large, smooth intervals.

Measurements — A cephalon: length 6 mm.; width 19 mm.; length of genal spine, 13 mm.; width of glabella, 5 mm. This is about the average size.

This species is very closely allied to *Ceraurus polydorus* Billings, from Table Head, Portland Creek, Newfoundland, which may account for the fact that the latter species has been listed from Valcour Island, by Brainerd and Seely.

Locality. — Trilobite layers, Sloop Bay, Valcour Island. A single specimen was found on the north end of Sloop Island. It occurs also in the Mingan Islands, Canada.

Ceraurus hudsoni sp. nov. (Plate 14, figure 15.)

Associated with the species just described is another common species, much resembling *Ceraurus pleurexanthemus* of the Trenton. To this abundant and fine species I wish to give the specific name, *hudsoni*, in honor of Professor George H. Hudson, of the Plattsburgh Normal School. Professor Hudson is an earnest student of the Chazy fauna, and to him I am under many obligations.

DESCRIPTION.

Cephalon. — Glabella broad, prominent, gently convex, expanding considerably toward the front. Glabellar furrows, three pairs, parallel to the neck furrow, the posterior pair turning back to join the neck furrow. Neck segment wide, convex, highest posteriorly. Fixed cheeks large, convex, extended at the genal angles into long spines which appear to be somewhat more divergent than in *Ceraurus pompilius*. Free cheek small. Eyes small, situated opposite the second glabellar lobe and some distance from the glabella. Glabella and cheeks covered with strong pustules of various sizes, many quite large. The genal spines and borders are ornamented with small, distant papillæ.

Thorax and pygidium unknown.

Measurements. — A cephalon: length 8 mm.; width 19 mm.; width of glabella in front, 7.5 mm., behind, 5 mm. Another: length 11 mm.; width 24 mm.; width of glabella in front, 10 mm., behind, 7.5 mm. A third: length 9.5 mm.; width 27 mm.

This species is closely related, on one side, to *Ceraurus pompilius* and, on the other, to *Ceraurus pleurexanthemus*. From *C. pompilius* it differs in having the glabella expanded toward the front and in the much larger and more prominent pustules on the surface. From *C. pleurexanthemus* it differs in having the cheeks smaller and more convex, and in having the eye further forward.

Locality. — Trilobite layers, Sloop Bay, Valcour Island.

Subgenus PSEUDOSPHEREXOCHUS Schmidt.

Pseudosphærexochus vulcanus. (Plate 14, figure 16.)

Cheirurus Vulcanus Billings, 1865, Paleozoic Fossils Canada, volume 1, page 284, figures 271, a, b, c.

Cheirurus prolificus Billings, 1865, Paleozoic Fossils Canada, volume 1, page 285 figure 273; page 325, figures 311, 312.

A single specimen obtained from an almost barren layer of gray dolomite in the reef at Smuggler's Bay, Valcour Island, proves to be identical with *Cheirurus vulcanus* Billings, from Division C of the Quebec Group, Cow Head, Newfoundland. *Cheirurus prolificus*

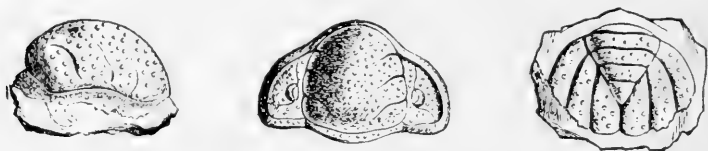


FIG. 10. *Pseudosphærexochus vulcanus* Billings. Reproduction of Billings' figures in volume I of the Paleozoic Fossils of Canada. The associated pygidium may belong to a *Lichas*.

Billings seems to be the same as *Cheirurus vulcanus*, and *Cheirurus Mercurius* Billings is another closely allied species, with, perhaps, sufficient difference in the character of the posterior glabellar furrows to allow it to retain its specific name.

DESCRIPTION.

Cephalon wide, the glabella very large and convex, the cheeks drooping. Glabella wide, convex, tapering very rapidly toward the front. There are three pairs of glabellar furrows, the first pair short, running a little forward, at first, and then backward; the second pair longer, running in almost perpendicular to the axis a short distance,

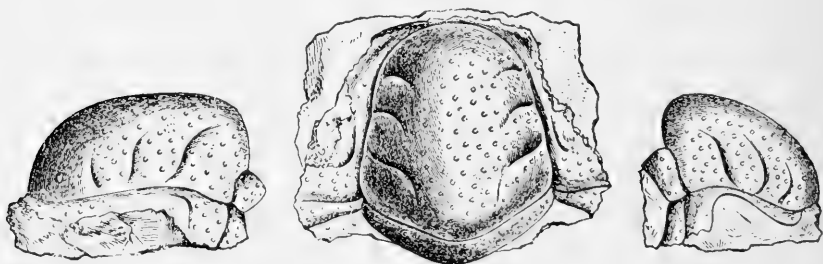


FIG. 11. *Pseudosphærexochus vulcanus*, Billings variety *billingsi*. Reproduced from Billings' figures in Paleozoic Fossils of Canada.

then turning backward, and then forward again, in a sigmoid curve. The last pair run backward and upward and when nearly to the summit of the glabella, turn backward, and, by a very slight depression, connect with the neck furrow. Fixed cheeks small; free cheeks rela-

tively large. Eyes small, very close to the glabella, and opposite the ends of the posterior pair of glabellar furrows. Entire cephalon bounded by a rather wide convex border. Surface sparsely covered with small tubercles.

Measurements.—Length of cephalon 13 mm.; width 26 mm. Width of glabella behind 13.5 mm. Width of glabella at the first pair of furrows 8 mm. Width between eyes 13.5 mm.

Locality.—The specimen figured—the only one the writer has seen—was collected by Mrs. Eleanor M. Hudson, who has very kindly allowed me to use the specimen for description. Acidaspis layers, Smuggler's Bay, Valcour Island.

Pseudosphærexochus vulcanus variety *billingsi*, variety nov. (Plate 14, figure 17.)

Cheirurus Vulcanus Billings, 1865, Paleozoic Fossils Canada, volume 1, page 324, figure 310a, b, c.

Not *Cheirurus vulcanus* Billings, 1865, Paleozoic Fossils Canada, volume 1, page 284, figures 271a, b, c.

At Standbridge, where *Cheirurus vulcanus* has been found in the Quebec group, it is accompanied by a variety which Billings figures in the paper cited above. This variety differs from the form just described, in having a narrower and much more elevated glabella, which does not taper so rapidly in front, while the posterior part of the glabella, instead of sloping down to the neck ring, is very high and abrupt, sometimes almost spiniform. (See figure 11.)

This variety occurs also at Valcour Island, where two specimens have been found by Professor Hudson in the Trilobite layers at Sloop Bay. The whole aspect of the cephalon is so different from the typical form of the species that it will be found convenient to distinguish it by the varietal name, *billingsi*.

Pseudosphærexochus approximatus sp. nov. (Plate 14, figure 18.)

Cf. *Cheirurus prolificus* Billings, Paleozoic Fossils, Canada, volume 1, plate 285, figure 273.

In the collection from the trilobite layer on the east side of Valcour Island is the glabella and fixed cheek of a species of *Cheirurus* which was at first identified with *Cheirurus prolificus*, but which a closer examination shows to differ somewhat from that form, though they must be closely related. *Cheirurus vulcanus* Billings, with which *C. prolificus* is probably identical, is also very similar.

DESCRIPTION.

Glabella convex, the highest part along the median line. Sides nearly parallel, expanding a trifle toward the front. Broadly rounded in front. There are three pairs of glabellar furrows which are not deeply indented. The posterior pair turn back and run nearly to the neck ring. Neck segment narrow, the furrow in front of it sharp and not deeply impressed. Eye lobe small, situated beside the posterior half of the second glabellar lobe and the anterior half of the third lobe. Fixed cheek small, triangular, and extending to the genal angle. Surface finely papillose.

Measurements. — A cranidium: length 7 mm.; width 13 mm.; width of glabella, 6 mm.

This species differs from *Cheirurus prolificus* Billings, in only two particulars. The glabella of that species tapers toward the front, while, in our species, it is as wide or wider at the front than at the neck segment. The posterior pair of glabellar furrows in *C. prolificus* make a sigmoid curvature, while, in our species, they turn back sharply at their posterior ends.

Locality. — Sloop Bay, Valcour Island.

Pseudosphærexochus chazyensis sp. nov. (Plate 14, figures 19, 20.)

In certain layers are occasionally found small glabellæ which may, at first glance, be taken for *Sphærexochus parvus*, but a closer examination shows them to belong to the subgenus *Pseudosphærexochus*. All the specimens, so far found, are glabellæ, and all are of small size. They occur mostly in the lower layers of the Chazy, nearly always associated with *Harpina antiquatus*.

DESCRIPTION.

Glabella small, very convex, tapering rapidly toward the front. There are three pairs of glabellar furrows, the first two pairs, short, and almost parallel to the neck furrow; the posterior pair slant backward little at first, but, as they get higher on the glabella, turn abruptly backward and reach nearly to the neck furrow. Surface covered with small papillæ. Neck ring narrow and convex. The largest specimen in the collection differs from the others in having only two pairs of glabellar furrows.

Measurements. — Largest glabella: 6 mm. long, 5 mm. wide. Another is 3 mm. long, 2.5 mm. wide.

This species differs from *Pseudosphærexochus vulcanus* in having a much narrower and more convex glabella, and from *P. vulcanus billingsi* by being much more tapering and in having the posterior part of the glabella much less elevated above the neck segment.

Locality. — Rather common in the upper part of the Chazy at Valcour Island and in the lower part at Chazy, New York. Types in the author's collection.

Pseudosphærexochus (Nieszkowskia) satyrus Billings. (Plate 14, figure 21.)

Cheirurus Satyrus Billings, 1865, *Paleozoic Fossils Canada*, volume 1, page 324, figure 309.

Unfortunately we are in a position to add little to Mr. Billings' description of this species, as it is represented in our collection by only a single individual. The specimen consists of the glabella and a portion of one fixed cheek.

DESCRIPTION.

Glabella very strongly convex, almost conical, and extending into a stout spine which projects vertically a little in front of the neck segment. There are three pairs of glabellar furrows. The posterior pair extends upward to the back of the spine, while the other pairs are shorter and do not turn back so far. Unfortunately the spine was broken off and lost. The neck segment is wide, almost flat, and has a small tubercle on the median line. The fixed cheek is large and coarsely pitted, while the glabella appears to be smooth.

Measurements. — The cephalon of our specimen is 20 mm. long and 38 mm. wide, while Billings' specimen, from Montreal, is only 5 mm. in length.

Locality. — In the coarse, gray, limestone on the north end of Sloop Island, east of Valcour Island, New York. Specimen figured, the property of Carnegie Museum.

Subgenus SPHÆROCORPHE Angelin.

Sphærocorphe goodnovi sp. nov. (Plate 14, figure 23.)

About half a mile south of Chazy, New York, in Mr. Robert McCullough's sugar bush, there occur, in pockets of fine, gray limestone, great numbers of exuviae of trilobites, chiefly small species of *Illænus*, *Asaphus*, *Lichas*, *Ampyx* and *Sphærexochus*. Among them

are many specimens of the bulbous part of the glabella of a new *Sphærocorphe*. In spite of the excellent state of preservation of these small globular portions of the trilobite, the writer has not been able to find a specimen which, on development, would show more than the glabella and a portion of a fixed cheek. Species of *Sphærocorphe* are, however, so rare in the American faunas, that it is thought worth while to describe what material we have and call the attention of collectors to this locality.

DESCRIPTION.

Glabella small, the bulbous frontal lobe occupying fully two thirds of the length. Back of the frontal lobe the two glabellar furrows meet on top, making a complete furrow over the glabella. Behind this are two small glabellar lobes and then the neck furrow, behind which is a narrow neck ring. Fixed cheeks short, triangular, but the genal angle is not well enough preserved to show whether or not it bore a spine. Eye rather large, projecting forward and about opposite the posterior glabellar lobes. Neck furrow extends across the fixed cheeks. Whole surface very finely tuberculated.

Measurements. — A cephalon: length 4 mm.; width 4.5 mm.; length bulbous part of glabella, 2.5 mm.; width 2.5 mm. Another: length 2 mm.; length bulbous part, 1.5 mm.; width 1.5 mm. There are one or two which are a trifle larger than the first one given above.

Locality. — So far the species has been found only in the middle Chazy limestones in Mr. Robert McCollough's sugar bush, a half mile south of Chazy village, New York.

Genus SPHÆREXOCHUS Beyrich.

Sphærexochus parvus Billings. (Plate 14, figure 22.)

Trilobite, genus undetermined, Billings, 1859. Canadian Naturalist and Geologist, volume IV, page 468, figure 36.

Sphærexochus parvus Billings, 1865. Paleozoic Fossils Canada, volume I, page 180, figure 160.

In spite of the fact that this little species is one of the most common fossils met with in the Chazy limestone, the glabella is the only part we find. Out of fifty specimens, now before the writer, only two show anything more than the glabella. One retains the cast of the posterior part of the left fixed cheek, and the other has the whole of the right fixed cheek showing the position of the eye.

DESCRIPTION.

Glabella almost globular, length and breadth about equal. There are three pairs of glabellar furrows: the first two pairs faint or not visible at all; the posterior pair deep, curving round to meet the neck furrow, isolating the posterior glabellar lobes. Neck segment narrow and the furrow deeply impressed. Fixed cheeks small, rounded at the genal angles, and with a wide border all around. Eye evidently large, opposite the next to the last pair of glabellar lobes and close to the furrow which outlines the glabella. There is a narrow rim anterior to the glabella. The whole surface is finely tuberculated.

Measurements. — Cephalon: length 3.5 mm.; width 6 mm.; width of glabella, 3.5 mm. Another cephalon: length 3 mm.; width 4 mm.; width of glabella, 2.75 mm. A glabella: length 8.5 mm.; width 8 mm.

Locality. — Common all through the Chazy limestone at Chazy, Valcour Island, Valcour, New York and Isle La Motte, Vermont.

REMARKS ON THE GENUS CHEIRURUS.

In reviewing the species which Billings has placed under the genus *Cheirurus*, it seems that the group is capable of some subdivision. For the American species, Clarke, in the Paleontology of Minnesota, has outlined a classification by which all are placed as species of *Ceraurus* and its subgenera *Cyrtometopus*, *Pseudosphærexochus*, *Nieszkowskia*, *Sphærocorphe*, *Eccoptochile* and *Crotalocephalus*. While his arrangement produces some natural groups, yet, as it is constructed on an artificial basis, it produces confusion in other groups. Only that part of the scheme which affects the Chazy species is here taken up.

Of the genus *Ceraurus* (sensu stricto) there are in the Chazy two species, *Ceraurus hudsoni* and *Ceraurus pompilius*, which evidently fulfill all the requirements of the genus by agreeing with the type species, *Ceraurus pleurexanthemus* Green. In the subgenus *Cyrtometopus*, the species *C. opollo* Billings, *C. mercurius* Billings, and *C. scofieldi* Clarke were associated. *Cyrtometopus scofieldi* Clarke differs from *Ceraurus* (restricted) only in the faintness of the first two pairs of glabellar furrows, and, in general, is very similar to *Ceraurus pompilius* Billings, in which species the anterior furrows are sometimes rather poorly impressed as compared with those of *Ceraurus pleurexanthemus*.

Cheirurus opollo Billings strongly resembles *Cheirurus vulcanus*, although the eyes are further forward, and it is probably nearly related

to the *Pseudosphærexochus* group, as the eyes are close to the glabella. *Cheirurus mercurius* Billings is so close to *C. vulcanus* and *prolificus*, that it is difficult to separate it specifically and certainly belongs to *Pseudosphærexochus*.

The group referred to Schmitt's subgenus *Nieszkowskia*, is an homogeneous one, including those species with spiniform projections on the glabella or with very high posterior elevations of the glabella. As thus defined, however, the group produces the anomaly of putting *Cheirurus vulcanus* in the genus *Pseudosphærexochus* and the variety *Cheirurus vulcanus billingsi* in the genus *Nieszkowskia*.

The group referred to *Sphærocorphe* is evidently correctly made up, and to it should be added *Sphærocorphe major* Ruederman and *S. goodnovi* Raymond.

The last division, *Pseudosphærexochus*, must be somewhat modified to include *Cheirurus vulcanus* Billings, *Pseudosphærexochus trentonensis* Clarke, *P. chazyensis* Raymond *P. approximatus* Raymond and *Pseudosphærexochus vulcanus billingsi*.

In the group there is a series of forms of which *Ceraurus* (sensu stricto) is the most primitive, tending from that genus to *Sphærexochus* by a constant decrease in the size of the fixed cheeks, an increase in the relative size of the free cheeks, a great increase in the relative size of the glabella and a gradual decrease in strength of the two anterior glabellar furrows. This variation is accompanied by a constant decrease in size.

Sphærocorphe is evidently a specialized offshoot in which the bulbous condition is carried, in some measure, to an extreme, and this form is not in the direct line, which would seem to pass through a form like *Cheirurus vulcanus* to forms like *Sphærexochus parvus*.

Nieszkowskia is a senile expression of *Pseudosphærexochus* and not to be considered in the line, except as an offshoot.

In Clarke's classification too much importance is given to the shape of the glabella and the direction of the glabellar furrows. These are very variable with each natural group, as, for instance, in *Ceraurus* (as restricted). The glabella may be either quadrate or expanded toward the front, while in *Pseudosphærexochus* it may be subtriangular or quadrate. The posterior lobe of the glabella may be isolated in *Ceraurus*, *Pseudosphærexochus*, *Sphærexochus* and *Crotalocephalus*.

Taking, however, for the important characters, the position of the

eye, the relative size of the fixed and free cheeks, and the proportion of the glabella to the rest of the cephalon, we arrive at the following grouping for the American Ordovician forms. This, it will be seen, differs from Clarke's only in the grouping of the species under two of the subgenera, although the subgenera must be redefined. The subgenus, *Nieszkowskia*, might be useful to designate a senile stage of the genus *Pseudosphærexochus*, but it can hardly be separated, as there are within the range of variation of one species, *Cheirurus vulcanus*, all gradations from typical *Pseudosphærexochus* to typical *Nieszkowskia*.

1. *Ceraurus* sensu stricto.

Free cheeks equal to or smaller than fixed cheeks. Eyes considerably removed from glabella. Glabella, usually subquadrate or expanding in front, less than one third the cephalon. Genal angles bear spines. Three pairs of glabellar furrows.

Ceraurus pleurexanthemus Green.

C. hudsoni Raymond.

C. pompilius Billings.

C. nuperus Billings.

C. tarquinius Billings.

C. scofieldi Clarke.

2. *Sphaerocorphe*.

Free cheeks smaller than fixed cheeks. Eyes far from glabella. Glabella a larger proportion of cephalon than in *Ceraurus*. Frontal, first and second lobes of glabella confluent. Genal angles bear spines.

Sphaerocorphe robusta Walcott.

S. salteri Billings.

S. major Ruedemann.

S. goodnovi Raymond.

3. *Pseudosphærexochus*.

Free cheeks larger than fixed cheeks. Eyes very close to the glabella. Glabella one third or more the width of the cephalon. Genal angles generally rounded.

In the section *Nieszkowskia* the glabella is very convex, abrupt behind, or produced into a spine.

Pseudosphærexochus trentonensis Clarke.

P. chazyensis Raymond.

P. approximatus Raymond.

P. vulcanus Billings.

P. mercurius Billings.

P. apollo Billings.

Section *Nieszkowskia*:

P. glaucus Billings.

P. perforator Billings.

P. satyrus Billings.

P. inimitor Billings.

P. mars Hudson.

Family PHACOPIDÆ Salter.

Genus *DALMANITES* Emmrich.

Subgenus *PTERYGOMETOPUS* Schmidt.

***Pterygometopus annulatus* sp. nov.**

Cf. *Pterygometopus callicephalus* Hall. *Emend.* Clarke. Paleontology of Minnesota, volume III, part II, page 731, figures 51, 52.

One of the most common trilobites met with on Valcour Island is a *Dalmanites* whose cephalon agrees closely with that of *Pterygometopus callicephalus* of the Trenton, but associated with it are numerous pygidia whose characters vary considerably in the different specimens, and none of them agree very closely with the pygidium of the Trenton species above mentioned. Heads and tails of this species are common, but no complete specimen has been found, although one specimen shows the pygidium and six of the thoracic segments.

DESCRIPTION.

Cephalon. — Cephalon short, broad, gently rounded, with a very short triangular projection in front of the glabella. Glabella shows three pairs of furrows. Frontal lobe large, sloping gently down to the front. Second pair of glabellar lobes strongly angulated, outlined by deep furrows. Second pair of furrows directed forward at about 30°, short, and the lobes back of them, small. Posterior lobes very small. The posterior part of the glabella differs from that of *P. callicephalus* in being much narrower. Fixed cheeks bear the genal angles, which are rounded and without trace of spines. Free cheeks small. Eyes large, extending from the neck furrow to the first pair of glabellar furrows.

Thorax. — Total number of thoracic segments not known. Axis high, about one third the width, tapering gradually. Segments narrow, turning down sharply at the sides. Segments on pleura deeply grooved.

Pygidium. — Pygidium somewhat triangular in some specimens, while others are so broad as to give a rather rounded outline. Axis high, outlined by deep furrows. It tapers somewhat to about the middle of the pygidium, then remains the same breadth to its end. It does not reach to the end of the pygidium and the space behind it is smooth. Axis has from ten to twelve sinuous annulations and the pluræ show six to eight ribs which are single for a part of their length and then bifurcate. They reach almost, but not quite to the margin. In some specimens the ribs bifurcate quite close to the axis, while on others the rib remains single more than one fourth its length. On some specimens the anterior portion of the rib continues much nearer the margin than the posterior part, thus forming a very characteristic appearance. On the axis are small pits between the annulations, which give a double curve to each side of each annulation. Both cephalon and pygidium are finely tuberculated.

Measurements. — A cephalon: length 8.5 mm.; width 17 mm.; width between eyes, 7.5 mm. Another: length 7 mm.; width 12 mm.; between eyes, 8 mm. A pygidium: length 10 mm.; width 13 mm.; axis 3.5 mm. wide in front. Another: 8 mm. long; 10 mm. wide; axis 2.5 mm. wide in front, 6 mm. long.

Locality. — All through the Chazy at Valcour Island. Type in Carnegie Museum.

CONCLUSION.

In the species which have been described on the preceding pages, all the orders of trilobites are represented, the Hypoparia by two families, two genera and three species, the Opisthoparia by five families, eleven genera and nineteen species, and the Proparia by three families, seven genera and eleven species. The Opisthoparia are most numerous, both in individuals and species. The Asaphidæ, with six genera, fourteen species and countless individuals seem to reach their culmination in these rocks.

Seven genera, *Thaleops*, *Proetus*, *Glaphurus*, *Cybele*, *Sphærocorphe*, *Sphærexochus* and *Pterygomotopus* make their first appearance in American faunas in this formation. Three, *Bathyurellus*, *Glaphurus* and *Amphion* are not found in formations above the Chazy.

Most of the genera found in the Trenton are represented in the Chazy by species similar to those in the upper formation, but a few, *Trinucleus*, *Cyphaspis*, *Nileus*, *Bronteus*, *Brongniartia*, *Calymene* and *Encrinurus* have not yet been found lower than the Black River. The close relationship of the Chazy and Trenton trilobite faunas is emphasized by the following table, which shows that there are three species common to the two formations and nineteen more which are represented in the Trenton by closely allied species. The names printed in SMALL CAPITALS are those of species which are very closely allied.

| Chazy species. | Trenton species. |
|---|--|
| HARPINA OTTAWAËNSIS, <i>Lonchodomas halli</i> , | HARPINA OTTAWAËNSIS, <i>Lonchodomas hastatus</i> , |
| REMIPLEURIDES CANADENSIS, | REMIPLEURIDES INGUATUS. |
| BATHYURUS ANGELINI, <i>Isotelus harrisi</i> , } | BATHYURUS EXTANS, { <i>Isotelus maximus</i> , |
| <i>Isotelus obtusus</i> , } | { <i>Isotelus gigas</i> , |
| ILLÆNUS INDETERMINATUS, <i>Illænus punctatus</i> , } | ILLÆNUS INDETERMINATUS, <i>Illænus americanus</i> , |
| <i>Illænus bayfieldi</i> , } | |
| <i>Illænus globosus</i> , } | <i>Bumastus trentonensis</i> , |
| <i>Illænus crastusi</i> , } | |
| THALEOPS OVATUS | THALEOPS OVATUS, |
| PLATYMETOPUS MINGANENSIS, | { PLATYMETOPUS TRENTONENSIS, |
| | { PLATYMETOPUS CUCULLUS, |
| PROËTUS CLELANDI, | { PROËTUS PARVIUSCULUS, |
| <i>Glaphurus pustulatus</i> , } | { <i>Proëtus latimarginatus</i> , |
| <i>Glaphurus primus</i> , } | { <i>Odontopleura parula</i> , |
| CYBELE VALCOURENSIS, | { <i>Odontopleura trentonensis</i> , |
| <i>Ceraurus pompilius</i> | CYBELE WINCHELLI, |
| CERAURUS HUDSONI, | <i>Ceraurus scofieldi</i> , |
| SPHÆROCORPHE GOODNOVI, | CERAURUS PLEUREXANTHEMUS, |
| | { SPHÆROCORPHE ROBUSTUS, |
| PSEUDOSPHEREXOCHUS VULCANUS, | { SPHÆROCORPHE MAJOR, |
| PTERYGOMETOPUS ANNULATUS, | PSEUDOSPHEREXOC HUSTRENTONENSIS, |
| | PTERYGOMETOPUS CALLICEPHALUS. |

When the trilobites of the Chazy are compared with those of the Calciferous considerably less agreement is found. The genus *Bathyurus*, which is so abundantly developed in the lower beds, is represented by only one species, and that one is not found in the region of the typical Chazy fauna. As has already been pointed out, *Asaphus canalis* of the Fort Cassin fauna has a representative in *Isotelus harrisi* of the

Chazy. *Pseudosphærexochus vulcanus*, which is the only trilobite common to the Calciferous and Chazy, occurs with the rest of the Fort Cassin fauna at Standbridge, Quebec. Such species as are represented by similar species in the Calciferous are given in the following table:

| Chazy species. | Fort Cassin fauna of Calciferous. |
|-----------------------------------|-----------------------------------|
| <i>Harpina ottawaensis</i> , | <i>Harpina cassinensis</i> , |
| REMIPLEURIDES CANADENSIS, | REMIPLEURIDES AFFINIS, |
| BATHYURELLUS MINOR, | BATHYURELLUS VALIDUS, |
| ISOTELUS HARRISI, | ISOTELUS CANALIS, |
| <i>Illænus erastusi</i> , } | { <i>Illænus incertus</i> , |
| <i>Illænus globosus</i> , } | { <i>Illænus tumifrons</i> , |
| <i>Platymetopus minganensis</i> , | <i>Platymetopus jukesii</i> , |
| <i>Amphion canadensis</i> , | <i>Amphion salteri</i> , |
| PSEUDOSPHEREXOCHUS VULCANUS, | PSEUDOSPHEREXOCHUS VULCANUS. |

The Fort Hunter fauna in the Little Falls dolomite of the Mohawk Valley, which was discovered by Harris and described by Cleland, has only one trilobite, *Asaphus canalis*(?) Cleland—an *Isotelus* with a spine-bearing genal angle—which resembles a Chazy form. The Calciferous of the Ottawa valley also has an *Isotelus* of somewhat similar type, and the Upper Kittating limestone of New Jersey contains an *Isotelus* which Weller refers to *Isotelus canalis*. The Calciferous of central Pennsylvania, according to Collie, contains an *Asaphus* which much resembles *Asaphus marginalis* Hall of the Chazy (not the *Asaphus marginalis* of this paper).

The next formation with which this fauna should be compared is the Newfoundland section, and it will be seen that the fauna of Division P, which has been referred to Lower Trenton time, contains several species which are closely related to species in our fauna.

| Chazy species. | Newfoundland, Division P. |
|-----------------------------------|--------------------------------|
| LONCHODOMAS HALLI, | { LONCHODOMAS NORMALIS, |
| | { LONCHODOMAS SEMICOSTATUS, |
| REMIPLEURIDES CANADENSIS, | REMIPLEURIDES SCHLOTHEIMI, |
| BATHYURELLUS BREVISPINUS, | BATHYURELLUS FORMOSUS, |
| <i>Illænus bayfieldi</i> , } | { <i>Illænus fraternus</i> , |
| <i>Illænus erastusi</i> , } | { <i>Illænus consobrinus</i> , |
| <i>Platymetopus minganensis</i> , | <i>Platymetopus jukesii</i> , |
| <i>Cybele vulcourensis</i> , | <i>Cybele mirus</i> , |
| AMPHION CANADENSIS, | AMPHION BARRANDEI, |
| CERAURUS POMPILIUS, | CERAURUS POLYDORUS, |
| PSEUDOSPHEREXOCHUS VULCANUS, | PSEUDOSPHEREXOCHUS VULCANUS. |

Although *Bathyrus angelini*, from the Chazy formation of the Ottawa valley, has been included in the descriptions and lists, it is not found in the typical Chazy deposits, and the so-called Chazy formation of the Ottawa valley is related to the true Chazy in little except its similar stratigraphic position. So far, only two trilobites are known from those rocks: *Bathyrus angelini* and an undescribed *Isotelus* which is frequently referred to under the name *Asaphus canalis*. The fauna of the lower sandstones is principally molluscan, although a species of *Camarotoechia* and an *Orthis* are abundant in one layer low in the section, and there is a layer of *Lingulæ* near the top. In the upper or limestone member the *Ostracoda* predominate, accompanied by several species of Mollusca and a *Camarotoechia*. This formation, which contains very few truly Chazy species, should be distinguished in some way and might take its name from the town of Aylmer, Quebec, where an excellent development of the Lower Aylmer, sandstone and shale, and Upper Aylmer, limestone, is shown.

Other formations which have a similar stratigraphic position to the Chazy are the Saint Peter sandstone, part of the Stones River in central Tennessee, and the limestone at Lenoirs, in east Tennessee.

The Saint Peter has yielded Sardeson no trilobites, nor have Ulrich and Bassler reported any as a result of their recent work in the central Tennessee region. In east Tennessee the writer has collected three species of trilobites at Lenoirs, which include an *Isotelus* allied to *Isotelus harrisi*, a larger *Isotelus* with a uniformly convex pygidium, and an *Illænus*, probably identical with *Illænus globosus*.

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1863. Geology of Canada, page 133, figure 69.

1865. Paleozoic Fossils of Canada, volume 1, page 288, figure 278.

Arionellus pustulatus Walcott.

See *Glaphyrus pustulatus*.

Asaphus canalis Conrad.

See text on *Isotelus harrisi*, page 343.

Asaphus canalis Billings.

See text on *Isotelus harrisi*, page 343.

Asaphus marginalis Hall.

1847. Paleontology of New York, volume 1, page 24, plate 4 bis, figure 15.

Asaphus obtusus Hall.

See *Isotelus obtusus*.

Asaphus platycephalus Stokes.

See text on *Isotelus harrisi*, page 343.

Bathyurus angelini Billings.

1859. Canadian Naturalist and Geologist, volume 4, page 467, figure 37.

Calymene multicosta Hall.

1847. Paleontology of New York, volume 1, page 228, plate 60, figure 3.

Probably a synonym of *Amphion Canadensis* Billings. The original specimen is not sufficient to define a species.

Ceraurus Hall.

1847. Paleontology of New York, volume 1, page 25, plate 4 bis, figure 20.

An indeterminable fragment.

Ceraurus pompilius Billings.

1865. Paleozoic Fossils of Canada, volume 1, page 181, figure 162.

Cheirurus pompilius Billings.

See *Ceraurus pompilius*.

Cheirurus prolificus Billings.

1865. Paleozoic Fossils of Canada, volume 1, page 325, figure 312.

Synonym for *Pseudosphærexochus vulcanus* Billings.

Cheirurus satyrus Billings.

See *Pseudosphærexochus satyrus*.

Cheirurus vulcanus Billings.

See *Pseudosphærexochus vulcanus*.

Glaphurus pustulatus Walcott.

1877. Thirty-first Annual Report New York State Museum Natural History, advance sheets, page 15.

1879. Thirty-first Annual Report New York State Museum, page 68.

Harpes antiquatus Billings.

See *Harpina antiquatus*.

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See *Harpina ottawaënsis*.

Harpina antiquatus Billings.

1859. Canadian Naturalist and Geologist, volume 4, page 468, figure 38.

1863. Geology of Canada, page 133, figure 67.

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1865. Paleozoic Fossils of Canada, volume 1, page 182, figure 165.

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Illenus arcturus Hall.

1847. Paleontology of New York, volume 1, page 23, plate 4 bis, figure 12.

Synonym for *Thaleops ovatus* Conrad.

Illenus bayfieldi Billings.

1859. Canadian Naturalist and Geologist, page 369, figures 4-6.

Illeenus clavifrons Billings.

1859. Canadian Naturalist and Geologist, volume 4, page 379.

Synonym for *Thaleops ovatus* Conrad.

Illeenus crassicauda ? Hall.

1847. Paleontology of New York, volume 1, page 24, plate 4 bis, figure 13.

Name preoccupied. Probably same as *Illeenus erastusi*, which see.

Illeenus globosus Billings.

1859. Canadian Naturalist and Geologist, volume 4, page 467, figures 1, 2, 3.

Illeenus ovatus Conrad.

See *Thaleops ovatus*.

Illeenus vindex Billings.

1865. Paleozoic Fossils Canada, volume 1, page 179, figure 160.

Synonym for *Thaleops ovatus*.

Isotelus obtusus Hall.

1847. Paleontology of New York, volume 1, page 24, plate 4 bis, figure 14.

Lichas champlainensis Whitfield.

1881. Bulletin of the American Museum Natural History, volume 1, page 342, plate 33, figures 6-8.

Synonym for *Platymetopus minganensis* Billings.

Lichas minganensis Billings.

See *Platymetopus minganensis*.

Lonchodomas halli Billings.

1862. Geological Survey of Vermont, volume 2, page 929, figure 365.

1865. Paleozoic Fossils of Canada, volume 1, page 24, figures 25a-c.

1893. American Geologist, volume 11, page 106, figure 5.

Platymetopus minganensis Billings.

1865. Paleozoic Fossils of Canada, volume 1, page 181, figure 163 a, b.

Pseudosphærexochus satyrus Billings.

1865. Paleozoic Fossils of Canada, volume 1, page 324, figure 309.

Pseudosphærexochus vulcanus Billings.

1865. Paleozoic Fossils of Canada, volume 1, page 284, figure 271; page 324, figure 310.

Remipleurides canadensis Billings.

1865. Paleozoic Fossils of Canada, volume 1, page 182, figure 167.

Sao ? *Lamottensis* Whitfield.

1881. Bulletin American Museum Natural History, volume 1, page 334, plate 33, figures 9-11.

Synonym for *Glaphurus pustulatus* Walcott.

Sphærexochus parvus Billings.

1859. Canadian Naturalist and Geologist, volume 4, page 468, figure 36.

1865. Paleozoic Fossils of Canada, volume 1, page 180, figure 160.

Thaleops ovatus Conrad.

1843. Proceedings of the Academy of Natural Science of Philadelphia, volume 1, page 332.

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1899. Report of the Geological Survey of Canada, section J, page 139.
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1901. Ruederman, R. The Trenton Conglomerate of Rysedorph Hill and its

Fauna. Bulletin of the New York State Museum, number 49.

Mentions *Ampyx halli* and *Remipleurides canadensis* in comparisons.

1902. Raymond, P. E. The Crown Point section. Bulletin of American Paleontology, volume 3, number 14.

Gives lists of Chazy fossils, including trilobites and figures *Thaleops ovatus*.

EXPLANATION OF PLATES,¹

PLATE 10.

1. *Harpina antiquatus* Billings. A cephalon, enlarged two diameters.
2. *Harpina ottawaensis* Billings. An imperfect cephalon, enlarged two diameters.
3. *Lonchodomas halli* Billings. A cranidium, enlarged two diameters.
4. The same species. Side view of cranidium, showing the upward slope of the rostrum, enlarged two diameters.
5. The same species. A pygidium and two thoracic segments, enlarged four diameters.
6. Posterior view of the same, enlarged four diameters.
7. The same, side view, enlarged four diameters.
8. *Remipleurides canadensis* Billings. Side view of cephalon, twice natural size.
9. The same, dorsal view, twice natural size.
10. The same species. Pygidium and last five thoracic segments, four times natural size.
11. *Bathyurus angelini* Billings. A cranidium, one third larger than the specimen.
12. The same species. A pygidium, one third larger than the specimen.
13. *Bathyurellus brevispinus* Raymond. A cephalon, enlarged two diameters.
14. The same, side view, enlarged two diameters.
15. The same species, dorsal and profile views of a cranidium, enlarged two diameters.
16. *Bathyurellus minor* Raymond. A pygidium, enlarged four diameters.
17. *Asaphus marginalis* Hall. A small cranidium.
18. The same species. Free cheek of a somewhat larger individual.
19. The same species. A small pygidium.
20. The same species. A slightly larger pygidium showing a peculiar projection on its posterior end.
21. *Isotelus bearsi* Raymond. A cranidium, the eye stalks broken.
22. Front view of a larger specimen of the same species showing eye stalks.
23. The same species. Dorsal view of free cheek.
24. The same, lateral view.
25. A small pygidium belonging to this species.

PLATE 11.

An outline drawing of a restoration of *Asaphus marginalis* Hall. One half the natural size indicated by fragments in the Carnegie Museum.

¹ Where not otherwise indicated, the figures are natural size.

PLATE 12.

1. *Isotelus obtusus* Hall. Outline of a complete specimen.
2. The same species. A pygidium and five thoracic segments.
3. *Isotelus harrisi* Raymond. An imperfect free cheek, showing the genal spine.
4. The same species. A small cranidium.
5. The pygidium of a large individual of this species.
6. The same species. Hypostoma.
7. Side view of another hypostoma.
8. *Asaphus*, species *alpha*. Pygidium, enlarged four diameters.
9. *Asaphus*, species *beta*. Pygidium, enlarged two diameters.
10. *Asaphus*, species *gamma*. Pygidium, enlarged four diameters.

PLATE 13.

1. *Illænus indeterminatus* Walcott.
2. The same species. A free cheek.
3. *Isotelus angusticauda* Raymond. A pygidium.
4. The same, side view.
5. *Thaleops ovatus* Conrad. An entire specimen, the test broken from glabella and pygidium. Enlarged two diameters.
6. *Illænus globosus* Billings. A small cephalon.
7. Thorax and pygidium of a larger individual of the same species.
8. *Illænus erastusi* Raymond. A cephalon of average size.
9. Pygidium of the same species.
10. *Illænus punctatus* Raymond. A small specimen, the cephalon distorted by pressure, enlarged two diameters.
11. *Illænus bayfieldi* Billings. Cephalon of one of the typical specimens.
12. Thorax and part of pygidium of the same.
13. *Proetus clelandi* Raymond. Cranidium of the type specimen, enlarged two diameters.
14. Profile view of the same, enlarged two diameters.

PLATE 14.

1. *Platymetopus minganensis* Billings. A cranidium, natural size.
2. The same species. A small pygidium, imperfect at the front, one third larger than natural size.
3. The same species. Outline of hypostoma, twice natural size.
4. *Glaphurus pustulatus* Walcott. A cranidium and part of thorax. Only such spines as show on a single specimen are represented. Twice natural size.
5. The pygidium of a large individual of the same species, enlarged three diameters.
6. The same species. An hypostoma, enlarged three diameters.
7. *Glaphurus primus* Raymond. Glabella and portion of fixed cheeks, enlarged two diameters.
8. Free cheek of *Glaphurus primus*, enlarged two diameters.
9. *Cybele valcourensis* Raymond. The pygidium, enlarged four diameters.
10. *Amphion canadensis* Billings. Dorsal view of an entire specimen.

11. Front view of the cephalon of the same specimen.
12. The same species. The pygidium of a larger specimen.
13. The same species. An hypostoma.
14. *Ceraurus pompilius* Billings. A cranidium, one third larger than natural size.
15. *Ceraurus hudsoni* Raymond. A cephalon with incomplete genal spines, one third larger than natural size.
16. *Pseudospherexochus vulcanus* Billings. An incomplete cephalon, twice natural size.
17. *Pseudospherexochus vulcanus billingsi*. Side view of an incomplete cranidium, twice natural size.
18. *Pseudospherexochus approximatus* Raymond. A cranidium, twice natural size.
19. *Pseudospherexochus chazyensis* Raymond. Side view of a specimen with two glabellar furrows, twice natural size.
20. The same species. A small glabella, three times natural size.
21. *Pseudospherexochus* (*Nieszkowskia*) *satyrus* Billings. Side view of an incomplete cephalon.
22. *Spherexochus parvus* Billings. Side view of an incomplete cephalon, enlarged two diameters.
23. *Spheroecorphe goodnovi* Raymond. A cephalon lacking the genal spines, enlarged two diameters.
24. *Pterygomelopus annulatus* Raymond. A cephalon, one third larger than natural size.
25. The same species. A small pygidium.

VII. THE CRAWFISHES OF WESTERN PENNSYLVANIA.

BY DR. A. E. ORTMANN.

Up to the present time, the crawfish fauna of western Pennsylvania was very incompletely known. Aside from the scanty records given in the monographic works on American crawfishes by Hagen (Ill. Catal. Mus. Harvard, 3, 1870) and Faxon (Mem. Mus. Harvard, 10, 1885), to which Faxon added a few other records (Proc. U. S. Mus., 20, 1898), we possess only a list of the species of crawfishes of Allegheny county, published by E. B. Williamson (Ann. Carnegie Mus., 1, 1901, 8-13). Unfortunately, this list was founded upon entirely insufficient material, and, consequently, later investigations have necessitated a number of changes and additions.

Hagen, in 1870, mentions two species from the State of Pennsylvania, of which one (*Cambarus affinis*) is said to be found also in the western part, at Pittsburgh (pp. 61 and 100, l. c.). This record, however, has not been substantiated by subsequent investigations; *Cambarus affinis* being restricted to the eastern portion of the state. Faxon, in 1885 (l. c., p. 165), mentions four species from the state, of which *three* are also recorded from the western part: *Cambarus bartoni*, *Cambarus diogenes*, and *Cambarus rusticus*. The latter species is said to come from Pittsburgh (p. 110), but, as the writer has ascertained now, this species is *not* found at Pittsburgh, and has not been found in any other part of the state, although it has been carefully searched for. Thus, the number of species actually known up to that date (1885) is only *two*, namely: *Cambarus bartoni* and *Cambarus diogenes*. In 1898 (l. c., p. 625) Faxon added a *third* species: *Cambarus obscurus*, from Westmoreland county.

Williamson, in 1901 (l. c.), gave the following *five* species from Allegheny county: *Cambarus bartoni* (and var. *robustus*), *Cambarus diogenes*, *Cambarus dubius*, *Cambarus propinquus*, *Cambarus rusticus*. Closer examination of the material preserved in the Carnegie Museum, that served as a basis for Williamson's paper, and its comparison with additional material, reveals the fact that only two of these species were correctly identified (*Cambarus bartoni* and *Cambarus diogenes*), while *C. dubius* turns out to be a new species, and *C. propin-*

quus and *rusticus* are really identical, belonging to one and the same species, which, however, is not to be called by either name, but is *Cambarus obscurus*. Consequently, Williamson's list of the crawfishes of Allegheny county really comprises only four species: *Cambarus bartoni*, *Cambarus diogenes*, *Cambarus nova species (monongalensis)*, *Cambarus obscurus*, and these four species are all that were known from western Pennsylvania up to the present time.

Extended collecting excursions undertaken by the present writer during the summer of 1904 have confirmed the presence of these four species in this region (or part of it), and have added two more species: *Cambarus propinquus*, from Erie and Crawford counties, and *Cambarus carolinus*, from Westmoreland, Fayette, and Somerset counties.

In studying the crawfishes of this region it was the special object of the writer to ascertain the exact boundaries of the distribution of each species, and, if possible, to correlate these boundaries with physical features of the country. The results obtained, although not yet complete in every respect, have proved to be highly interesting and apt to throw light upon the postglacial immigration of the freshwater fauna into this part of the state. At the same time, numerous observations on ecology, habits, and life-history of the different species have been made, which shall be set forth in a larger paper comprising the crawfish fauna of the whole state, since, at present, they are too fragmentary to be presented.

The present paper is to be regarded only as a preliminary account of the work done in the western portion of the state. This portion is sharply separated in its fauna from the central and eastern portions and comprises, generally speaking, the drainage of the Ohio River (Ohio, Monongahela, Allegheny), and consequently belongs to the Mississippi system. Only the northwestern corner of the state (parts of Erie and Crawford counties) does not belong here, draining into Lake Erie (St. Lawrence system), but it is included on account of its geographic situation, and the remarkable faunal conditions presented by it. Thus we may say that western Pennsylvania, as understood in the following pages, means that part of Pennsylvania that lies west of the divide between the waters that run to the Atlantic ocean (Delaware, Susquehanna and Potomac), and the waters that drain through the Ohio to the Mississippi and the Gulf of Mexico. This dividing line runs, roughly speaking, through Potter, McKean, Elk, Clearfield, Indiana, and Cambria counties, and thence along the main chain of the Alle-

gheny Mountains between Cambria and Somerset counties in the west, and Blair and Bedford counties in the east.

Within the region thus defined we have the following six species of *Cambarus*: (1) *Cambarus bartoni* (F.), (2) *Cambarus carolinus* Er., (3) *Cambarus monongalensis* nov. spec., (4) *Cambarus diogenes* Gir., (5) *Cambarus propinquus* Gir., (6) *Cambarus obscurus* Hag.

With the exception of *Cambarus monongalensis*, all these species are rather well known, although two of them (*C. carolinus* and *obscurus*) were considered as quite rare. To facilitate the identification of these species, the following key is offered.

- I. Species belonging to the third group of the genus (type: *C. bartoni*). Ischium (third segment) of third pair of legs of male hooked. First pair of abdominal appendages of male terminated by two thick, strongly recurved teeth. In all Pennsylvania species the rostrum has no lateral spines, and the lateral parts of the carapace, behind the cervical furrow, possess generally no spines (with occasional exceptions in *C. bartoni robustus*).
 - A. Areola wide. Form of carapace depressed. Color (in life) brownish or greenish olive. (Mountain brook species.) C. BARTONI.
 - B. Areola narrow or obliterated. Form of carapace compressed. (Burrowing species.)
 1. Areola narrow. Color in life remarkably bright, of tints unusual among crawfishes. Abdomen distinctly shorter than carapace.
 - a. Color bright red (chiefly so on chelæ and anterior part of carapace). Rostrum broad and short. (Mountain species.) C. CAROLINUS.
 - b. Color bright blue (chiefly so on chelæ and anterior part of carapace). Rostrum narrower, short. (Hill species.) C. MONONGALENSIS.
 2. Areola obliterated in the middle. Color of the usual tints in crawfishes: greenish or brownish olive. Abdomen about as long as the carapace. Rostrum rather long and narrow. (Bottom land species.) C. DIOGENES.
- II. Species belonging to the fourth group of the genus (type: *C. affinis*). Ischium of third pair of legs of male hooked. First pair of abdominal appendages of male terminated by two slender, styliform, nearly straight teeth. In the Pennsylvanian species, the rostrum has a lateral spine on each side, the carapace has a spine on each side behind the cervical furrow, and the areola is wide. Color green or brownish olive, with a reddish spot on each side of the anterior margin of carapace, below eye. (River and lake species.)
 - A. Rostrum with median keel. First pair of abdominal appendages of male at base of terminal teeth without prominent angle. Annulus ventralis of female flat. C. PROPINQUUS.
 - B. Rostrum without median keel. First pair of abdominal appendages of male at base of terminal teeth with a distinct, prominent angle on the anterior margin. Annulus of female with two tubercles in anterior part. C. OBSCURUS.

REMARKS ON THESE SPECIES AND RECORDS OF THEIR RANGE.

I. CAMBARUS BARTONI (Fabricius). The Common or Barton's
Crawfish.

This well-known species (for detailed description see Hagen, 1870, p. 75) is easily recognized by the characters given in the key. Aside from the group-characters (form of male organs), the broad rostrum without lateral teeth, and the wide areola distinguish it from any other species of western Pennsylvania.

It is found, as Williamson states, in springs and smaller brooks, rarely in larger streams. Here it scoops out shallow holes under stones, and very often makes quite deep burrows, piling up the mud, sand, or gravel at the entrance in more or less regular piles, often assuming the shape of "chimneys." Wherever there are favorable localities in our region, this species is found, as it seems to be present all over the state. The older records mention *C. bartoni* only from a few places in western Pennsylvania: Foxburg, Clarion county (Girard); McKean county (Faxon, 1885); Westmoreland county (Faxon, 1898). Williamson records it as common in Allegheny county. According to the collections in the Carnegie Museum (made by E. B. Williamson, Dr. D. A. Atkinson, and the writer), it is found in the following counties: Greene, Fayette, Somerset, Washington, Beaver, Allegheny, Westmoreland, Butler, Clarion, Mercer, Crawford, Erie, McKean, Potter. According to material preserved in the collections of the Academy of Natural Sciences, Philadelphia, it is also found in Warren county. This renders it a certainty that it is to be looked for everywhere in the western part of the state. In Erie county, the typical *C. bartoni* is not very abundant, although present, and is largely replaced by the variety *robustus*. (See below.)

In the larger rivers this species is lacking, or found only occasionally, and the writer has observed that in large rivers it is found chiefly, where there are springs along the banks. These springs contain, in summer, generally much cooler water, and it is in this cooler water where *C. bartoni* is found, this species apparently disliking the warmer water of the large streams. In the Allegheny and Ohio Rivers, below Butler Junction in the northeastern corner of Allegheny county, it is exceedingly rare, only stragglers occurring there. In the upper Youghiogheny and Casselman Rivers, above Indian Creek in Fayette county, this species is found regularly, although not very plentiful,

and it is, in this region, the only species that inhabits the rivers, *C. obscurus*, the typical river-species, being absent here.

Cambarus bartoni goes far up into the mountains: the highest elevation at which it was collected is at Sand Patch, Somerset county, about 2,300 feet above sea level; here it was abundant in little mountain streams above the western entrance of the B. & O. R. R. tunnel.

This species attains, in the southwestern section of the state, a considerable size. Hagen (1870) gives 3.6 in. = 91 mm. as maximum size; according to the writer's observations, specimens from eastern Pennsylvania rarely grow beyond 60 mm. (largest male in Carnegie Museum, from near Valley Forge, Chester county, 61.5 mm.; largest female, from Wissahickon, Philadelphia county, 64 mm.), while in western Pennsylvania much larger specimens are not rarely met with; the largest male of the first form in the Carnegie Museum collections is from North Versailles township, Allegheny county (opposite Stewart, Westmoreland county), and measures 83.5 mm.; the largest female is from Hill, Westmoreland county (opposite Leechburg, Armstrong county), and measures 89 mm. (A male of the first form from Cheat River, West Virginia, is 92 mm.)

The color of *C. bartoni* is more or less brownish olive, in young specimens often rather greenish, in old ones frequently with coppery or bronze hue. The shade of color is quite variable, but generally it is more brownish than in other species. Rarely there are individuals of a bluish hue, but this blue is never bright and brilliant (as in *C. monongalensis*) but rather dull, like blue slate or clay. Often the shell is rendered more or less blackish by the deposit of a mud incrustation upon it.

1a. CAMBARUS BARTONI ROBUSTUS (Girard).

As has been done by most writers, I regard this form as a variety of *C. bartoni*. It differs chiefly in the shape of the rostrum, which is more elongate and narrower than in the typical form. Hagen, who mentions this form as a good species, gives the following additional characters: the large chela has a distinct impression near the outer margin of the hand, both above and below; the inner margin of the hand has a double row of tubercles; and the carapace has a spine on each side behind the cervical furrow. These characters, however, are not always distinctly developed, and, among the specimens from Allegheny county, the lateral spine is generally wanting, although we

possess a few in which it is present. In specimens from Erie and McKean counties, this spine is found more frequently, but not always. The impressions of the hand, and the double row of tubercles of its inner margin are often very indistinct, and chiefly so in young specimens, so that it is sometimes hard to tell whether a particular individual belongs to this variety or not, since also the shape of the rostrum shows transitions to the typical form, and very young individuals of the latter generally have a more elongate rostrum. Nevertheless, old and full-grown examples of this variety are easily recognized.

This form was first reported from western Pennsylvania by Williamson, who says that a few specimens of it have been taken in Squaw Run, near Aspinwall, Allegheny county. Additional material in the Carnegie Museum collected by Dr. D. A. Atkinson comes from Pine Creek, below Bakerstown Station and from Chartiers Creek, Carnegie, Allegheny county. The writer has collected this variety in Squaw Run, and further in McKean county, in the Allegheny River near Larabee, and in French Creek at Union City, Erie county. He has found it abundantly in Erie and Crawford counties in the drainage of Lake Erie: at Conneautville Station, Crawford county, in a small tributary of Conneaut Creek; in Temple and Conneaut Creeks near Albion, Erie county; in Elk Creek near Girard, Erie county; in Walnut Creek at Swanville, Erie county. There are a large number of specimens in the Philadelphia Academy collections from a tributary of the Allegheny River near Port Allegheny, McKean county.

In Allegheny and Crawford counties this variety was found with the typical form, and was comparatively rare. The specimens from Port Allegheny in the Philadelphia Academy were associated with a much smaller number of typical *C. bartoni*. At Larabee, the writer found only this form in the Allegheny River (associated with *C. obscurus*), but the typical form was abundant in small streams. In Erie county in French Creek, as well as in the lake drainage, this variety prevails, the typical *C. bartoni* being very rare there in the larger creeks, but the latter may be more abundant in small streams, which have not been examined. In Erie county it was always associated with either *C. propinquus* or *C. obscurus*. According to Williamson, this form is generally found in that part of the streams where *C. bartoni* and *propinquus* (correctly *obscurus*) come together, and this is quite right. However, there are many streams where this variety is not found at all, and the writer has never seen it in the southwestern

section of the state (Washington, Greene, Westmoreland, Fayette, and Somerset counties).

C. bartoni robustus attains a very large size, even larger than the typical form. The largest male of the first form is from Albion, Erie county: 94 mm.; a male of the second form from the same place is 95 mm. The largest female is from Squaw Run, Allegheny county, and measures 94 mm. Hagen gives 3.2 in. = 81 mm., and Faxon 86 mm.

2. CAMBARUS CAROLINUS Erichson. The Red Crawfish.

As Hay (Proc. Biol. Soc. Washington, 15, 1902, p. 38) has pointed out, *C. carolinus* Erichson is identical with *C. dubius* Faxon.

This species is easily recognized in the field by its color. It is of a vivid red, chiefly so on the anterior part of the carapace and on the chelæ, the color being hardly subject to any variation, except that it is more brilliant in newly molted individuals. But even in old shells, the bright brick-red of the anterior part of the body is very striking. The sides and abdomen possess often a more or less brownish (leather-brown) tint, and frequently old shells are covered by a black or brown coat of dirt, but even then the chelæ and parts of the carapace remain clean and red.

The morphological characters of this species have been well brought out by Faxon (1885, as *C. dubius*). The compressed shape of the carapace is similar to the following species, while in the wide rostrum it resembles *C. bartoni*. In the shape and the armature of the chelæ, aside from the shape of the rostrum, are found the chief differences from *C. monongalensis*: in *C. carolinus* the outer margin of the hand is serrated, this serration being produced by a series of pits (punctations) forming a regular longitudinal row along this margin. The carpopodite of the chela has a single strong spine on the inner side, all other spines on this side being absent. Lower side of meropodite of the chelipeds armed with two rows of spines, the inner row being longer consisting of about 6 spines, the outer one being shorter, and consisting of only 3 or 4 spines.

There is some variation in the shape of the rostrum. Pennsylvania (and Maryland) specimens never have the rostrum as wide as in Faxon's figure (l. c., pl. 4, fig. 3), and generally the margins converge a little. But there are specimens in which they are "subparal-

lel," as Faxon states. The lateral corners of the margins, where they pass into the short, triangular acumen, are generally quite sharp.

The type-locality of this species is Tiger Hall Farm, Greenville, Green county, South Carolina (*C. carolinus* Er., see Faxon, 1885, pp. 9 and 56). The type of Faxon's *C. dubius* is from Cranberry Summit (called now Terra Alta), Preston county, West Virginia, on the divide between the upper Youghiogheny and Cheat Rivers. Additional localities, recorded previously, are: Pennington Gap, Lee county, Virginia; Cumberland Gap, Claiborne county, Tennessee (Faxon, 1885); "among the Cherokees," Indian Territory (Faxon, Proc. U. S. Mus., 12, 1890, p. 624), and Hay says that it is found in southwestern West Virginia. I have collected this species, outside of the state of Pennsylvania, at Selbysport, Garrett county, Maryland (Youghiogheny valley). In Pennsylvania, it has never been found before, but is quite abundant in the mountain region between Chestnut Ridge and the main chain of the Allegheny Mountains, in Somerset, Fayette, and the southern extremity of Westmoreland county. Special localities are the following: Somerset county: Rockwood, at about 1,900 feet elevation; Meyersdale, about 2,000 feet; Listie, 1,900-2,000 feet; Fayette county: Dunbar, abundant on Chestnut Ridge at 1,260 feet elevation; stragglers associated with *C. diogenes* at 1,070 feet elevation; Indian Creek, 1,900 feet; Ohiopyle, in Rainier Park, 1,250 feet. In Westmoreland county, I found this species only in the southern extremity, in the region of the headwaters of Indian Creek at Jones Mills, about 2,000 feet elevation.

Thus it appears that this is a true mountain species, being found generally at an altitude from 1,200 to 2,000 feet above sea level (in Pennsylvania). The Chestnut Ridge forms its boundary toward the northwest, the Allegheny Mountains toward the southeast. It belongs chiefly to the drainage of the upper Youghiogheny and Casselman Rivers, but at Listie, Somerset county, it has crossed the transversal divide in the longitudinal valley between the Laurel Hill and Allegheny Mountains, and is found in the headwater region of Stony Creek that runs to the Conemaugh. How far it extends north here is unknown, but it is surely not present in the neighborhood of Cresson, Cambria county.

The new locality at Selbysport, Maryland, connects the Pennsylvania range with the type-locality of *C. dubius* in Preston county, West Virginia.

Cambarus carolinus is, as has been first reported by Faxon, a burrowing species, and makes holes in swampy and springy ground on the mountains. Favorite localities are swampy meadows on the top of the hills or on the hillsides, often apparently dry at the surface, but containing at the depth of one to two feet a supply of fresh spring water, generally with a substratum of stiff clay. The holes of this species are very complex, having very often several openings, each of which is crowned by a more or less regular "mud-chimney." At Ohiopyle, I have dug them out of holes, two or three feet deep, the holes forming, at this depth, a very intricate system of caverns and tunnels, branching off more or less horizontally in various directions. In certain parts of Somerset county, and in Garrett county, Maryland, this species is a real pest, seriously interfering with farming on account of its burrows and mud chimneys.

Faxon gives 62 mm. as the maximum size for this species. I have a male of the first form from Dunbar, Fayette county, which is 63.5 mm. long, and a female from Ohiopyle, Fayette county, which measures 80 mm. There is no doubt that adult males also attain a similar size, but it is hard to take them on account of the depth to which the holes of old individuals go down.

3. *CAMBARUS MONONGALENSIS* species nova. The Blue Crawfish.

Diagnosis. — A species belonging to the third group (*C. bartoni*), being most closely allied to *C. carolinus*, but differing in the following characters:

1. Rostrum narrower, a little variable in shape, but generally with margins more convergent, and the lateral angle at the base of the acumen less well defined.

2. Armature of chelæ different. Outer margin of hand not serrated, being swollen and evenly rounded, the pits (punctuations) never forming a regular longitudinal row on the edge. Carpopodite with more than one spine on the inner side. Generally, one spine is the largest (the one corresponding to the spine of *C. carolinus*), but there are always several other small spines or spine-like tubercles. Lower side of meropodite only on the inner edge with a row of spines, the outer edge is smooth, with a single tubercle at its distal end.

3. Color blue. It is most brilliant on the anterior part of the carapace and on the chelæ, being of a deep ultramarine hue, shading to sky-blue on the sides. Distal part of the fingers of chelæ orange or

reddish-brown. Margins of rostrum generally purple. Tubercles of chelæ whitish or reddish.

Description. — Carapace compressed. Abdomen shorter than carapace. Rostrum short, not very wide, triangular, margins convergent, suddenly contracted to the triangular, short acumen; lateral angles at base of acumen not sharp, more or less rounded. Upper surface of rostrum slightly concave. Postorbital ridges short, often indistinct, without spines. No lateral spines on carapace, but sides slightly granulated. Areola narrow, with one or two irregular rows of dots. Suborbital angle indistinct, rounded. Anterior part of epistoma sub-quadrangular. Anterior segment of telson with one spine on each side. Antennæ shorter than body, scale small. Large chela ovate, surface punctate. Inner margin of hand serrated by a single row of tubercles. Outer margin rounded and entire, without any serrations. Fingers conical, slightly down-curved, gaping at base, with teeth at their cutting edges. Outer margin of movable finger with deep pits, but without tubercles. Carpopodite with a strong spine on the inner margin, and a smaller spine proximally of it, and further, there are two or three more spine-like tubercles on the lower inner side. Mero-podite with the superior border almost smooth, only with one or two indistinct distal tubercles. Lower side with a row of spines on inner edge, outer edge smooth, with one single distal tubercle. Hooks on third pair of legs of male; shape of male copulatory organs of the type of the third group. Color always with more or less brilliant blue, tubercles of chelæ whitish or reddish, finger tips reddish or orange.

Largest male of the first form, from Gordons Valley, Edgewood Park, Allegheny county, 67 mm.; largest female from same locality, 76 mm. (Another female from Monaca, Beaver county, has the same size.)

The above characters are constant. The blue color is very striking, and is always present on the anterior part of the body. Posterior part of carapace and abdomen sometimes of a purplish hue, and very often there is a blackish or brownish mud deposit on old shells. Shape of rostrum very variable, but always narrower than in *C. carolinus*, and with more convergent margins. The armature of the chelæ varies slightly with respect to the number of spine-like tubercles of the carpopodite, but the spines are always more numerous than in *C. carolinus*.

This species is geographically entirely isolated from *C. carolinus*, and never found associated with it. The boundary between them is

formed by the northwestern slope of the Chestnut Ridge, and *C. monongalensis* is found distributed on the hills lying on the west and northwest of this ridge. The range of this species comprises the northwestern part of Fayette county, Washington county and parts of Westmoreland, Allegheny and Beaver counties. It has not yet been found in Greene county, but is undoubtedly also present there. In Beaver and Allegheny counties, the valley of the large rivers, Ohio and Allegheny, apparently forms the northern boundary of this species: in fact, it has been found north of these rivers only at a single locality near Squaw Run, Allegheny county (by Dr. D. A. Atkinson), while it is very abundant on the hills south of these rivers. In Allegheny county, south of the Allegheny River, whence it has been reported by Williamson under the name of *C. dubius*, it is present everywhere, in swampy places on the hills, generally at an elevation from 900 to 1,100 feet, rarely going farther down (in Schenley Park and Fern Hollow, within the city line of Pittsburgh, it descends to a little below 800 feet). It is especially abundant on the hills east of Wilkinsburg and Edgewood Park, and specimens from the latter locality (head of Gordon's Valley, Edgewood Park, elevation 1,000-1,100 feet) have been taken as the *types* for the above description. The oldest specimen in the Carnegie Museum collections is from Moon township, Allegheny county, and was collected by A. T. Shafer in 1898 (Cat. no. 74.20),

In Westmoreland county this species has been found at Braeburn, on hills above the Allegheny River, at Jeanette, and it reaches the valley of the Kiskiminetas at Hill (opposite Leechburg, Armstrong county). In Beaver county it is abundant on Doctor Heights, Monaca, south of the Ohio.

In Washington county it has been found at Monongahela City, at Francis Mine (near Burgettstown), and near Taylorstown.

In Fayette county it is present near Smithfield and Cheat Haven.

Thus it has been traced from the southern state line in Fayette county (Cheat Haven) to the northernmost point of the Ohio River (Monaca), and almost to the point of the triangle formed by the Kiskiminetas and Allegheny Rivers (Hill and Braeburn); and from the foot of the Chestnut Ridge to near the western state line in Washington county (Taylorstown and Francis Mine), and very likely occupies all of the state that is included between the Chestnut Ridge to the east, the Ohio-Allegheny Rivers to the north, and the southern and western

state lines to the south and west respectively. The exact location of the northeastern boundary in Westmoreland county has not yet been ascertained, possibly it is formed by the Loyalhanna or Conemaugh.

Like *C. carolinus*, this species is a burrowing species and a chimney builder. The holes are made in a similar way as those of *C. carolinus* but generally are not quite as complex, although more so than those of *C. diogenes*. Swampy pastures and fields on the hillsides, with a permanent supply of spring water, are the favorite localities, and such places are often entirely undermined by the burrows, and thickly studded with chimneys of *C. monongalensis*.

There is no doubt that this species has a close genetic connection with *C. carolinus*, but it is certainly specifically different. I never met with a case in which I was in doubt about these two species, the peculiar color distinguishing them at once, and moreover, their mutual geographic separation supports their specific validity. They never have been found associated at the same place, the northwestern escarpment of the Chestnut Ridge forming a sharp boundary between them.

The specific name *C. monongalensis*, has been suggested by the fact that most of the range of this species belongs to the drainage system of the Monongahela River.

4. CAMBARUS DIOGENES Girard. The Mud Crawfish.

From the allied species, *C. carolinus* and *monongalensis*, this one is at once distinguished by the shape of the rostrum and the areola, aside from the color. The rostrum is more elongate and narrower, often being lanceolate without a trace of an angle or sinus at the base of the acumen, the latter being not at all marked. In other cases, the acumen is distinguishable. The areola is "obliterated," that is to say, the two lines confining the branchial regions are in actual contact in the middle of the carapace for a certain distance. Sometimes however the areola is not quite obliterated, there being a narrow space left between the two lines: this is chiefly the case with specimens from Fayette county. For the rest, this species is easily recognized by the tubercles of the inner margin of the hand, which always form more than one row, generally two, often with traces of additional rows, while in *C. carolinus* and *C. monongalensis* there is always one row only.

The color of *C. diogenes* differs entirely from that of either of the

two last named. It is more or less of the usual pattern among crawfishes, namely brownish or greenish olive. In well-developed, adult individuals, there is generally (in western Pennsylvania) a beautiful verdigris-green present on the base of the fingers, which, together with the orange-red finger-tips and the reddish margin of the rostrum, renders the coloration of such specimens rather vivid and attractive. But there are great variations in color: a specimen found in the fall of 1903 in Fern Hollow, Pittsburgh, in a puddle of yellowish-brown mud had assumed entirely this yellowish-brown mud color. A remarkable variety was found at Dunbar, Fayette county: a large male of a prevailing red color, similar to *C. carolinus*, but less brilliant. This apparently is to be regarded as a case of albinism; although found associated with *C. carolinus*, this specimen possesses all the typical morphological characters of *C. diogenes* and moreover, typically colored individuals were abundant at the same place.

C. diogenes is a well-known species occupying a wide range in the United States.¹ In Pennsylvania it was recorded hitherto only from Derry, Westmoreland county (Faxon, 1885), and from Pittsburgh, Allegheny county (Williamson). The investigations of the writer, and additional material in the Carnegie Museum, collected by others, have shown that it is quite abundant in the southwestern section of the state. In Allegheny county it is common, being found chiefly in the bottom lands along the rivers, but it also goes up to the elevation of about 900 feet (200 feet above the rivers), apparently following upwards the valleys and ravines that empty into the large rivers. In Westmoreland county it is abundant at Derry (already recorded by Faxon), and has also been taken at Blairsville Intersection. In Washington county it has been found at Francis Mine (near Burgettstown); in Greene county, near Waynesburg; in Fayette county, near Smithfield and Dunbar, at the foot of the Chestnut Ridge. East of Chestnut Ridge, in Fayette, Somerset and Westmoreland counties, it is positively wanting: careful search for it in Ligonier Valley and the drainage of the upper Youghiogheny and Casselman Rivers has been unsuccessful. Its northern boundary is at present not well known: the most northern point is just below Bakerstown Station, Richland township, Allegheny county, but it may pass into Butler and Armstrong counties, which have not yet been examined satisfactorily.

It may be mentioned here that *C. diogenes* is also present in east-

ern Pennsylvania, whence it has never been reported before, although it is known from New Jersey (Trenton); the writer discovered it at Ridley Park and Marcus Hook in Delaware county.

The distribution of this species is quite puzzling; the curious fact that it is found both east and west of the Allegheny Mountains, but that it is clearly missing in the high plateau between Chestnut Ridge and Allegheny Mountains (at least in Pennsylvania), and that it is also absent from the region lying to the east of the main mountain chain, and does not appear till we reach the lowlands on the Delaware River, is not easily explained, unless there is a connection across the mountains somewhere south of the southern state line. It has been reported by Faxon from Deer Park, Garrett county, Maryland, but this record needs confirmation, since we rather ought to expect here another species, *C. carolinus*. A closer investigation of western Maryland, and eastern and northern West Virginia will probably throw light upon this question.

Cambarus diogenes is the best known of the "chimney builders." It prefers the bottom lands along the large rivers, but goes quite regularly up the valleys, where it often comes into contact with *C. monongalensis* or *C. carolinus*. Generally, if *C. diogenes* is found at a given locality, *C. monongalensis* or *carolinus*, if found associated with it, are less abundant, but become more frequent, and finally are exclusively found, if we go higher up on the hillsides. The holes of *C. diogenes* are decidedly less complex than those of the other two species; very often they consist only of a single shaft, generally going down in a slanting direction, that ends in a pocket; rarely there are lateral branches.

Western specimens of *C. diogenes* attain a very considerable size (4.5 in. = 115 mm., Hagen). The largest individuals from Pennsylvania represented in the Carnegie Museum are: a male of the first form from Nine Mile Run, Pittsburgh, 92 mm., and a female from Dunbar, Fayette county, 95 mm.

5. CAMBARUS PROPINQUUS Girard. The Lake Erie Crawfish.

This species is easily recognized when adult males of the first form and adult females are at hand. Young and undeveloped specimens are rather hard to distinguish from *C. obscurus*. It differs from all the preceding species by the characters of the fourth group, the form of the male appendages, and further, by the rostrum, which possesses a

lateral spine on each margin, by the presence of a lateral spine on the carapace, and by the wide areola. All these characters, however, are common to the next species (*C. obscurus*). It differs from the latter in the shape of the copulating organ of the male of the first form, which has no prominent angle on the anterior margin below the base of the terminal teeth, and in the shape of the annulus ventralis of the female, which is flat and has no prominent tubercles. Besides, I have been able to discover, in living specimens, a difference in color. While generally the color of both species is very similar (greenish-olive, with some brown on the abdomen, and a reddish spot on the anterior margin of the carapace below the eye),¹ there is a difference in the color of the finger-tips; in *C. propinquus* the tips are brownish, preceded by a pale or yellowish band, while in *C. obscurus* there is, proximally of the brown tips, a dark green or even blackish band, often followed again by a pale yellowish band.

There are a few other differences. In *C. propinquus* the rostrum possesses a median keel, which is wanting in *C. obscurus*, but in Pennsylvania specimens of *C. propinquus* this keel is sometimes very indistinct. The chelæ in *C. propinquus* are generally more swollen and less broad and flattened than in *C. obscurus*, and, except for punctations, are smooth with a double row of small tubercles on the interior margin of the hand. The fingers are straight, in old males they are very slightly gaping at the base, and the outer margin of the dactylopodite is only very slightly curved.

In *C. obscurus* the chelæ of old males are more flattened and broader, the fingers are widely gaping at the base, and the dactylopodite is strongly curved, the curve being S-shaped, with a distinctly and strongly concave outer margin. The palm possesses tubercles on the upper side besides the double row on the inner margin; generally there is a row of tubercles running parallel with the margin toward the middle of the base of the dactilopodite; sometimes there are additional scattered tubercles between this latter row and the inner margin.

As has been said, young specimens are not easily identified, since these characters, chiefly the sculpture of the chelæ, are not well developed, but I am able to distinguish young males of the second form by the shape of the copulatory organs. Here in both species the prominent angle at the base of the terminal part is missing, but in *C.*

¹ This spot has been first observed by Williamson in *C. obscurus*, but by a misprint (p. 13) he states that this blotch is on the *posterior* margin of the carapace.

propinquus the tip of the internal part is pointed, while in *C. obscurus* it is blunt.

Cambarus propinquus is restricted, in Pennsylvania, to Lake Erie and the Lake Erie drainage. In the lake itself it has been found at Presque Isle (Dr. D. A. Atkinson coll.), and near Miles Grove (picked up alive on the beach by the writer). Of the tributaries of the lake, it is present in Conneaut Creek, associated with *C. obscurus*, at Albion, Erie county, but is exclusively found in some smaller creeks running to Conneaut Creek, Temple Creek at Albion, and in a small, nameless tributary below Conneautville Station, Crawford county. With *C. obscurus* it is found in Elk Creek, between Girard and Miles Grove, and it is found without *C. obscurus* in Walnut Creek at Swanville.

The largest specimens of *C. propinquus* in the Carnegie Museum collections are from Albion, Erie county, and measure: male of first form, 61.5 mm.; female, 69 mm. Hagen gives 2.3 in. = 66 mm. for this species.

6. CAMBARUS OBSCURUS Hagen. The River Crawfish.

The differences from *C. propinquus* have been set forth above, and are the following: (1) Lack of median keel of rostrum; (2) armature and shape of chela, which, however, is well developed only in large males of the first form; (3) shape of male copulatory organs; (4) shape of annulus of female; (5) color of finger-tips. (In old, dirty and soiled shells the color markings are largely obscured.)

Hagen gives 3.5 in. = 89 mm. for this species. The largest specimens in our collections are: male of first form from Ohio River, Stowe and Neville townships, Allegheny county, 86 mm.; female from Pucketty Creek, Allegheny county, 93 mm.

C. obscurus is the river form of western Pennsylvania, and prefers larger streams. Generally, the specimens are found under stones, where they scoop out a little hole for their accommodation. Rarely they dig short tunnels, and they do this chiefly on gravelly banks in the rivers, where there are no larger stones. If stones are lacking, they make short holes in muddy or peaty banks. These holes are very artless, running generally in a horizontal direction for a few inches, rarely more than a foot, just below the level of the water. The workings of this species are often indicated by insignificant mud or sand piles in front of their holes, generally more or less obliterated by the action of the water.

This species has been reported hitherto only from two localities: the type locality in the Genessee River at Rochester, New York (Hagen), and from Westmoreland county, Pa. (Faxon). Williamson mentions *C. propinquus* and *rusticus* from the Allegheny, Monongahela and Ohio Rivers in Allegheny county, but as the specimens in the Carnegie Museum show, his *propinquus* represents young specimens of *C. obscurus*, while his *rusticus* is founded upon full grown males and females of the same species.

C. obscurus is, aside from *C. bartoni*, the most abundant species in western Pennsylvania, and belongs, generally speaking, to the drainage of the three great rivers, Ohio, Allegheny and Monongahela. It is very numerous in the Ohio in Beaver and Allegheny counties, and has also been found in creeks running westward through the panhandle of West Virginia to the Ohio, for instance in Harmons and Buffalo Creeks in Washington county. It has been traced up the Allegheny River from Allegheny county through Clarion, Venango, Warren counties (specimens from Corydon are in the Academy in Philadelphia), then into New York state (Salamanca, Cattaraugus county, specimens in the Philadelphia Academy), and back into Pennsylvania, McKean county. Up the Monongahela River it has been traced to the Cheat River at Cheat Haven, Fayette county, and up the Youghiogheny as far as Connellsville, Fayette county, and the Indian Creek at Jones Mills, Westmoreland county. In the Kiskiminetas and Conemaugh, it goes as far as Blairsville Intersection, Westmoreland county, and up the Loyalhanna into Ligonier Valley. In the Beaver and Shenango Rivers it goes to Crawford county, and in French Creek at least as far as Union City, Erie county. Within the area thus outlined, it is found also in smaller streams up to a certain point, which cannot be defined in a general way, till it is replaced by *C. bartoni* occupying the rough and cooler waters near the source of each stream.

The presence of *C. obscurus* has been established in the following counties: Greene, Fayette, Washington, Westmoreland, Beaver, Allegheny, Butler, Clarion, Venango, Erie, Crawford, Warren, McKean; all these belong to the Ohio drainage. But there are a few additional remarkable facts. (1) The upper Youghiogheny and Casselman Rivers do not contain this species, and it is thus lacking in southeastern Fayette and in Somerset counties. This species goes up the Youghiogheny as far as Connellsville, and probably a little beyond,

since it enters the Indian Creek, but above the region where the Youghiogheny cuts through Laurel Hill and Chestnut Ridge it is not found any more. (2) This species is also found outside of the Ohio drainage, namely: (*a*) in Erie county, in the lake-drainage in Conneaut Creek at Albion, and in Elk Creek at Miles Grove; (*b*) in the Potomac drainage, in Wills Creek near Hyndman, Bedford county. This latter locality, although not properly belonging to western Pennsylvania, as defined above, is mentioned here, since it will give occasion to a very interesting zoögeographical discussion, for which, however, the investigations have not been finished.

REMARKS ON THE GEOGRAPHICAL DISTRIBUTION OF THE CRAW-
FISHES OF WESTERN PENNSYLVANIA.

Only a few points shall be mentioned here, in order to call attention to some remarkable facts of the distribution, which will be discussed more fully in a subsequent paper.

We may leave alone *C. bartoni*, which is found everywhere in the state, and its variety *robustus*, for which only slender material is at hand. *C. carolinus*, *monongalensis* and *diogenes* are restricted to the southwestern section of the state. The distribution of *C. carolinus* plainly indicates immigration from the south along the high plateau and longitudinal valleys included between Chestnut Ridge and Allegheny Mountains. In the valley between Chestnut Ridge and Laurel Hill, it managed to reach the cross divide between Indian Creek and the Loyalhanna River in Westmoreland county, without crossing it, while in Somerset county it has crossed the transversal divide between Casselman River and Conemaugh system. *C. monongalensis* very likely is its parallel form on the low plateau (Cretaceous peneplain?) northwest of the foot of the Chestnut Ridge: it has not yet been traced beyond the limits of the state, but reports are at hand that it is also found in West Virginia.¹ Northward, the Ohio-Allegheny-Kiskiminetas River seems to form the boundary of its distribution: this is highly interesting, in so far as a large river marks in this case a barrier to the further dispersal of an aquatic creature, but this is easily understood, if we take account of the peculiar habit of this species of living in springs on the hill-tops. Apparently, this species also came from the south, and migrated on the hills parallel with the gen-

¹ Such reports have been obtained from unprofessional people, and cannot be given, unless verified.

eral direction (south to north) of the Monongahela and Youghiogheny Rivers, and was stopped in its progress by the first large cross-valley encountered, that runs in an east-west direction.

The distribution of *C. diogenes* is not yet fully understood. Its area in western Pennsylvania somewhat resembles that of *C. monongahensis*, although it goes beyond the limits of the latter in a northerly and northeasterly direction, crossing the Allegheny River in Allegheny county, and the Loyalhanna in Westmoreland county. At present, no physical features of the country have been discovered that might furnish a barrier to the dispersal of this species northward, although it is certainly not found in the northern half of western Pennsylvania. Toward the east, the Chestnut Ridge limits this species. The presence of this species in eastern Pennsylvania further complicates this question.

With respect to the river-species, *C. obscurus* and *propinquus*, at the first glance, conditions appear simple, the first belonging to the Ohio drainage, the second to the Lake Erie drainage. We have seen, however, that parts of the Ohio drainage, namely, the upper Youghiogheny system, do not possess *C. obscurus*, it apparently finding its boundary where this river is rushing over falls and rapids through the narrow gorge of the Laurel Hill and Chestnut Ridge. This fact clearly proves that at least in the Youghiogheny the dispersal of this species was directed up stream. On the other hand, *C. obscurus* is found, together with *C. propinquus*, in certain parts of the Lake Erie drainage. Here, I think, we have to deal with a case of stream piracy, the capturing of the headwaters of one system by another one. In our case, we know, that the drainage features of Conneaut Creek and French Creek have entirely changed from what they were in pre-glacial times; but this part of their history does not bear upon the present case, the immigration of both river species into these parts undoubtedly belonging to postglacial times. Thus we are led to believe that quite recent changes of drainage have taken place here, which may be generally explained as a tapping of the drainage of French (and possibly also of Shenango) Creek by Conneaut and Elk Creeks cutting back through the original divide, which was formed by moraines. Together with the waters, certain elements of their fauna were thus deflected. In this respect it needs special attention, that, while *C. obscurus* has thus become a member of the fauna of the Lake Erie drainage, the opposite has not taken place with reference to *C.*

propinquus, and the latter species is strictly confined to the lake drainage; this is an important fact in so far as it demonstrates that no passive transport has played a part in the dispersal of these species, for, if it had been possible for *C. obscurus* to become colonized by transport (through water-fowl, etc.), in the Erie drainage, the same agents must have worked also in the opposite way, and should have been able to transport *C. propinquus* into the Ohio drainage. But this is not the case. Our material from the whole immense area occupied by the Ohio drainage contains not a single individual that shows the slightest approach to *C. propinquus*, although hundreds of specimens from various parts have been examined.

The peculiar presence of *C. obscurus* in the Potomac drainage at Hyndman is possibly due to similar causes and has a similar bearing; but since the solution of this question is to be sought for apparently in parts outside of our territory, we shall here refrain from discussing it.

It is hoped that the writer may be able to continue and enlarge the above studies, so that it will be possible, in a future memoir, to discuss the whole state of Pennsylvania. If this work is carried out, the distribution of the different species chiefly with regard to their post-glacial immigration into their present range will be elucidated, and, it is needless to say, very interesting results will be obtained, as is already indicated by the above short and preliminary sketch.

VIII. SOME NOTES ON THE GEOLOGY OF SOUTHWESTERN MONTANA.

BY EARL DOUGLASS.

While exploring the Tertiary deposits of southwestern Montana, I have become interested in some of the older formations, and have made collections from those which contain fossils. Several of these collections have been submitted to specialists, who have sent me lists of the fossils, and have given their opinions concerning the ages of the beds containing them. I am especially indebted to F. H. Knowlton, Geo. H. Girty, and T. W. Stanton, of the United States Geological Survey, and to Percy E. Raymond of the Carnegie Museum, for determining fossils and furnishing the lists, which have been of so much interest to me in my geological work.

ARCHÆAN.

Under this head I include only the gneisses and schists which are Pre-Cambrian and generally recognized as Archæan. Concerning the more massive granites, regarding the age of which there is doubt, and which are probably in part of later age, I have little to say.

I have observed the Archæan rocks in the following localities:

1. In the region between the lower and upper Madison Valleys, where the Madison River has made a long cañon through these rocks;
2. In the western portion of the Madison Range, and in the eastern portion of the Jefferson Range, which includes the Tobacco Root and the South Boulder Mountains, where they have been mapped by the United States Geological Survey;¹
3. On the western slopes of the Jefferson Range;
4. Along the lower cañon of the Ruby (Passamari) River nearly west of Old Baldy Mountain;
5. In the Ruby Mountains;
6. In the vicinity of Rochester. This region is between Table Mountain on the north and McCarty's Mountain on the south, and

¹ Atlas Folio No. 24.

between the Jefferson Valley on the east and the Big Hole Valley on the west.

The relief of these areas varies from hills projecting above the Tertiary deposits, through low, variously-shaped foot hills and ridges, higher hills, and low mountains, to peaks, which, like Gallatin Peak, attain an altitude of ten thousand feet or more.

The rocks of this formation are, as a rule, fairly well covered with vegetation, sometimes with heavy forests. In some places the dip is quite regular and the stratification plain. This is especially the case along Alder Creek on the western slope of the Tobacco Root Range. In other places there is much contortion and the stratification is not so evident.

As determined in the field, without careful classification, the rocks would be denominated as quartzite schists, metamorphic quartzites, mica schists, hornblende schists, chlorite schists, micaceous gneiss, granitoid gneiss, garnetiferous gneiss, etc.

The rocks contain many veins of nearly pure quartz and some valuable metalliferous deposits. In the early days of mining in Montana the quartz mines were principally in Archæan rock. At present nearly all the evidence indicates that the vast amount of placer gold which has been taken from Alder Gulch came from near the contact between the Archæan and Cambrian, probably from the upper part of the Archæan, at the foot of Old Baldy Mountain at the head of Alder Creek.

On Camp Creek east of Melrose there is an excellent section of the Palæozoic rocks overlying the Archæan gneiss. Their relations are shown in the sketch of the section of this region, made in traveling up Camp Creek in going from Melrose to Rochester. Though, as stated in my notes which I quote later, I did not carefully examine the exact line of contact between the Archæan and Palæozoic, I did ascertain that rock which is apparently Cambrian quartzite is very close to if not in actual contact with the gneiss.

THE ALGONKIAN?

In several localities in the Cordilleran region of Montana there are beds different from the gneisses described above, and lying beneath rocks which contain undoubted Cambrian fossils. They present a problem which will require much work for its solution, and which in the present state of our knowledge is quite puzzling. I have ascertained

that some of these beds, the ones containing the crystalline limestone, overlie the Archæan gneiss in the Ruby Mountains. In some places they are entirely absent and the Cambrian rests on the gneiss.

The relations of the Archæan, doubtfully Algonkian, undoubted Algonkian, and Cambrian I will discuss more fully later.

THE CHERRY CREEK FORMATION.

Some beds of metamorphic rock near the eastern base of the Tobacco Root Range in the Upper Madison Valley southeast of Old Baldy Mountain, and on the opposite side of the Madison River at the western base of the Madison Mountains were named by A. C. Peale "The Cherry Creek Beds," and were assigned to the Algonkian. They were described as, "a series of marbles or crystalline limestones, and interlaminated mica-schists, quartzites, and gneisses." They were undoubtedly named from Cherry Creek which flows through the exposure.

Only eight or ten miles distant from the typical locality at the foot of Old Baldy Mountain, what are undoubtedly Cambrian (Flathead) quartzites rest directly on Archæan gneiss. Below this Alder Creek cuts through a thick series of gneisses and schists. In this series I have never seen the thick beds of crystalline limestones, though I have many times observed the outcrops along the whole length of Alder Creek; nor does Peale designate them on the map of this region. But they may have been weathered more than the gneisses and become covered with soil and vegetation, thus escaping notice. They appear again, however, in the Ruby Cañon west of Old Baldy. I observed several years ago what I took to be a limestone vein in the gneiss in the hills south of Alder Creek.

Westward and northwestward of the exposure of the limestones in the Ruby Cañon they occur on the eastern slope of the Ruby Mountains. Here in beds lower in altitude, in a sandy stratum, I found a trilobite, which was determined by S. A. Miller as *Asaphiscus wheeleri*. This sandstone contained green grains, which appear to be glauconite. Geologically the beds are undoubtedly higher than the crystalline limestones, but time was not taken here to settle the stratigraphical relations.

But farther to the north in the highest portion of the Ruby Mountains I found along the highest ridges a section, showing the relation of the crystalline limestones to the gneiss, and of this to the Cambrian.

On June 25, 1902, I ascended one of the cañons (Taylor) that have their beginnings near the crest of the Ruby Mountains and extend eastward as deep valleys or ravines in the Palæozoic rocks to the Ruby valley. I copy from my notes :

“ After passing some limestone pillars, showing peculiar weathering, I came to the thin-bedded Subcarboniferous limestone [Madison Laminated Limestones] with fossils. In the upper part of the cañon the Subcarboniferous is near to the gneiss. On the top the rock is gneiss dipping northeast or between east and north. I turned toward the north, ascending a higher ridge, and finally came to crystalline limestone. I was anxious to find the relation of this to the gneiss, and so went back perhaps 20 or 30 rods in the gneiss and saved samples² of the different kinds of rock from the gneiss, and then went a long distance up into the crystalline limestone. The limestone is nearly uniform, but with some layers that are different from the main mass. . . . This limestone makes a very high sharp ridge. . . . Above this I found another band of gneiss. I then began down in the limestone and saved samples through the band of gneiss, the shales that lie above it, and the Cambrian limestones which were identified by the fossil trilobites which it contained.”

So here we have the following :

5. Cambrian limestone with trilobites ;
4. Shales (undoubtedly Flathead shales) ;
3. Gneiss ;
2. Crystalline limestone ;
1. Archæan gneiss.

I made no measurements, but the narrowest of the divisions is probably not less than 150 to 200 feet in thickness.

It is probable that the crystalline limestones and a portion of the gneiss here represent the Cherry Creek formation. If it be thought that the upper band of gneiss might be metamorphosed Cambrian rock we would have a sudden change from the highly altered to the unaltered Cambrian which is evidently not due to local Post-Cambrian metamorphism.

The western portion of the Ruby Mountains in the vicinity of Dillon is gneiss, but I have not examined all the area that intervenes between this and the eastern crest just alluded to.

²In the collection of the University of Montana.

ALGONKIAN.

Not greatly Metamorphosed.

In portions of middle western Montana there are thick and extensive exposures of sandstones, slates, and shales or argillites, with some conglomerate and limestone, which in some places, at least, are known to lie beneath Cambrian rocks.

A portion of the beds in the vicinity of their eastern outcrops have been mapped and described in the atlas sheets and other publications of the U. S. Geological Survey, which give the results of research here. They have been observed in the Big Belt Mountains, Bridger Mountains, the Horseshoe Hills (west of the northern portion of the Bridger Mountains between this range and the Missouri River), and in the mountains northeast of Helena.

In the region west of the Rocky Mountains similar rocks cover a large area. Between the meridian of 113° and the Bitter Root Mountains, and between the parallels of 46° and 47° they are more common than any other rocks. In the region around Missoula there is little other rock older than the Tertiary. The Hell Gate Cañon from Missoula to Beramouth and the lower portion of the Big Black-foot Valley are in quartzites and slates that are probably Algonkian. In the western exposures they appear to be on the whole more arenaceous.

All of these beds are distinctly stratified, sometimes very thinly laminated and beautifully banded. The prevailing color is reddish, or brown, of the color of iron rust, with bands and series of layers which are green. In the Smith River Valley there are cream-colored shales or slates which break into thin flakes. At a distance the color and the general relief make them appear like the Miocene deposits which occur in the same locality.

These beds do not, as a rule, have a very ancient appearance. They are not highly metamorphosed. The sandstones have been changed to quartzites, but of course that is common in deposits of all ages. They are seldom greatly disturbed. They usually dip at gentle angles and there is not that almost inextricable confusion in which the Palæozoics, especially the Devonian and Carboniferous, have become entangled, in so many localities. In places where the Palæozoic limestones are near or in contact with the Algonkian, the former is often greatly distorted and disarranged, sometimes forming rugged,

almost perpendicular masses, while the latter forms comparatively smooth slopes, whether gentle or steep, and the rock has a much more regular dip. These rocks, too, usually form graceful hills and mountains with regular slopes and wide V-shaped valleys with forested ravines and wooded and grassy inclines fashioned into pleasant upland copses, woodlands, and parks, even to the tops of the highest mountains, in great contrast with mountains where the Palæozoic limestones predominate. Of course in the Algonkian, where series of hard quartzites prevail, the scenery is sometimes more rugged.

West of the Rocky Mountain divide the formation is, for the most part, carved into mountains, low, of medium height, and extensively covered with evergreen timber.

With the exception of the eastern portion, where a few fragmentary fossils have been found and described by Dr. C. D. Walcott, the rocks appear to be almost destitute of fossils. I have searched many times for any vestige of plant or animal life, but have found nothing, with the possible exception of tracks in the vicinity of Missoula.

The deposits were made, at least to a great extent, in comparatively shallow water. The slates and quartzites are commonly ripple-marked and in some places these markings are the finest I have seen.

I do not remember noticing any place where these Algonkian beds, which have just been described, are resting on Archæan gneiss.

The Bitter Root Mountains west of the Bitter Root Valley are composed to a great extent of granite and granitoid gneiss. I once examined the rocks in Bear Creek Cañon. They are different from the so-called Archæan gneiss east of the main divide but I noticed that part of the rock in the cañon was gneiss and schist, and that it had the appearance of stratification and dipped to the east. It has been considered of late origin, but some of it may be metamorphic.

RELATIONS OF PRE-CAMBRIAN ROCKS.

The older Pre-Cambrian rocks have not been studied sufficiently here to warrant any decided opinion concerning the problems involved. I wish, however, to present one or two questions of general geological importance. First I wish to avoid confusion with regard to names and will define the terms as I shall use them.

1. Archæan gneisses. The various gneisses and schists usually having the appearance of stratification known to underlie rocks of Cambrian age and often in direct contact with them.

2. The Cherry Creek Formation. (*a*) "A series of marbles, or crystalline limestones and interlaminated mica-schists, quartzites and gneisses,"³ in the foothills in the region of Cherry Creek in the Upper Madison Valley.

Cherry Creek Formation? (*b*) A thick body of massive crystalline limestone and a body of a similar thickness of stratified gneiss which lies between Archæan gneiss and the Cambrian shales. This probably is the equivalent of the Cherry Creek formation, but to avoid possible confusion, I will call these for the present the Ruby crystalline limestone and gneiss.

3. The Belt Formation. (*a*) Coarse and fine-grained sandstones, quartzites, red and green slates and shales, and in the Horseshoe Hills north of the Gallatin valley, containing conglomerates near the base, and higher in the series silicious limestone and argillites. This formation occurs in the Horseshoe Hills, in the Belt Mountains, in Smith River Valley and in other places.

(*b*) Reddish quartzites and slates and green slates and argillites principally in the region of Missoula, Montana. Again to avoid confusion I will call these the Missoula quartzites and slates.

By referring to the Three Forks Atlas Sheet it will be seen that the Belt beds are in all the localities of their exposures overlain by Cambrian strata, and in the region north of the Gallatin there is no doubt as to the Cambrian age of these latter rocks. In the Bridger range the relations are the same — that is in the portion represented on this sheet. But on the Livingston sheet it is seen that in the southern part of the Bridger range the Cambrian is in contact with the Archæan. South of this the Belt beds are not seen.

If we now refer to the Little Belt Atlas Folio we seem to find what we wish, viz.: the relation of the Algonkian to the Archæan. Here on three sides of the town of Neihert the Belt beds are represented as lying between Archæan gneisses and schists below and Cambrian rocks with Middle Cambrian fossils above. But on page 1 of this folio Mr. Weed says: "The older rocks of the region are the gneisses and schists found in the Little Belt Range in the northwestern part of the quadrangle. They are in part at least of igneous origin, Being a complex of rocks whose relations and origin are uncertain, and forming a group whose characters are alike throughout and differ from all other formations, they are considered to be of Archæan age."

³ Three Forks Atlas Folio, No. 23.

So they differ in some respects from the gneisses in the region of Virginia City and other places to the southward in not showing traces of stratification.

The Belt Terrane is here divided into the Neihert quartzite and the Belt formation. Their total thickness is 5,000 feet.

Only two or three miles southwest of this area and in part contiguous to it the Cambrian is represented as being in contact with the Archæan.

If we now turn to the Cherry Creek formation and the Ruby crystalline limestone and gneiss we meet the same difficulties. In the typical locality for the Cherry Creek formation we find by referring to the Three Forks Folio, that, south of Ruby Creek, the Cambrian is in contact with the Archæan, while to the north of the creek it is in contact with the Cherry Creek beds. I have not personally noted the contact here. At the foot of Old Baldy Mountain not far distant I have done so, and there is no trace of the limestones of the Cherry Creek beds. A few miles farther to the west, as stated before, the Ruby crystalline limestones are in contact with the gneiss.

Why do beds thousands of feet thick thin out so suddenly? On page 2 of the Three Forks Folio the following statement is made: "To the northward beyond the limits of the district, these beds [Belt] attain a thickness of 10,000 or 12,000 feet. In the northern quarter of the area the Belt formation immediately underlies the Flathead quartzite but to the southward it is absent and does not intervene between the Archæan and the undoubted Cambrian, and the formation certainly was not laid down on the Archæan except within a comparatively narrow strip of the northern edge of the area shown on the map, and even here the actual contact has not been seen."

It seems to me that there are other possible alternatives than the theory that Algonkian rocks were not deposited where they are not now found. It seems incredible that 6,000 or 7,000 feet of sandstone slates and arenaceous limestones should be laid down in one locality and nothing be deposited ten miles or less away. Evidently shores of seas must advance or recede unless the agents which tend to build out the shore lines are exactly balanced by the invasion of the waves and tides. But it hardly seems possible that this could be continued for an inconceivably long age so that fine sediments a mile or two in thickness should suddenly decrease to zero.

The theory that the Cherry Creek beds and the similar ones of the

Ruby Mountains were formed by metamorphism of the Belt beds is naturally suggested, but this would not get rid of all the difficulty, for both are apparently absent from a great part of the area in the regions in which they occur. Gneisses probably underlie all the sedimentary rocks, but the ones containing the crystalline limestones appear at present to be confined to a restricted portion of the Tobacco Root and Ruby Mountain Ranges. Perhaps more careful observation may extend this area.

Above the old gneisses the first beds that are fairly constant, so far as my observation goes, are quartzites that are apparently Flathead quartzites. In some places they surely are. I will not say that these are not sometimes wanting, but they, at least, are widely distributed, as are the shales and limestones above. These latter are said to contain Middle Cambrian fossils.

The idea that after the deposition of Algonkian strata there were continental conditions, with upheavals, faulting, and a vastly long period of erosion, presents itself, but this theory like all others has apparent difficulties as a sufficient explanation of all the data. The truth is in all geological inquiry imagination is apt to run far ahead of observation and it often hinders the accumulation of facts which would help toward the settlement of the problem.⁴

PALÆOZOIC.

Dr. A. C. Peale, in his "Palæozoic Section in the Vicinity of Three Forks, Montana," (Bull. 110, U. S. Geol. Surv.), has described the excellent Palæozoic section here. The studies of the various areas mapped by W. H. Weed, of the United States Geological Survey, and my own observations, show that the upper portion of the Palæozoic, especially, possesses much local variation in lithological and other characters, and its more thorough study will undoubtedly be interesting.

I give a sketch section made on Camp Creek east of Melrose. With the Three Forks Section there is a general similarity, and though I found fossils only in the Devonian shales, yet the different members of the series can be assigned to their position in the scale with a fair degree of probability. This section is interesting, as only

⁴For an interesting discussion of the relations of these different formations see "Pre-Cambrian Fossiliferous Formations." C. D. Walcott. *Bull. Geol. Soc. Amer.*, Vol. 10, pp. 210-215.

about fifteen miles south of here, at Zeigler's Cañon of the Bighole River, a most beautiful section supplements that on Camp Creek. The first-named one begins with the Archæan and ends with the massive Carboniferous limestone, while the section at Zeigler's Cañon begins with the upper Carboniferous quartzites and goes through Permian?, and a thick series of Mesozoic rocks, probably to the Tertiary.

CAMBRIAN AND DEVONIAN.

Regarding these formations I cannot add much to what has already been published. The Cambrian, though it varies locally, appears to be more nearly uniform lithologically than the formations extending upward from the Carboniferous. In an outcrop on the crest of the Ruby Mountains it contains many *Trilobite* heads, as it does on the Gallatin near Logan. At the foot of these mountains farther to the south, in a glauconitic sandstone, I found some *Trilobite* remains which S. A. Miller identified as *Asaphiscus wheeleri*. What has the appearance of Cambrian limestone occupies a small exposure in the Algonkian area south of Missoula, on the Bitter Root River, opposite Lo Lo Creek.

The Devonian shales, about three or four miles northwest of Three Forks, are fossiliferous and contain finely preserved Brachiopods and Cephalopods. Mr. George H. Girty identified a small collection sent to him. The following is the list:

Spirifer disjunctus.

Cleiothyris n. sp.

Camarotoechia Tethys.

Pugnax pugnus.

Goniatites (2 sp.).

The shales on Camp Creek contain a few fossils.

CARBONIFEROUS.

The Carboniferous here is well worthy of a careful study. The lithological characters, especially in the upper portion, are not so uniform as we might expect in marine formations.

Bridger Mountains.—The rocks of the Bridger Mountains have been mapped in the Three Forks Folio. On Bridger Peak, in the Madison limestone, I found the following new species which were named and described by S. A. Miller:⁵

⁵ Bulletins 10 and 12 of the Illinois State Museum.

Poteriocrinus bozemanensis Miller.

Poteriocrinus douglassi Miller.⁶

Platycrinus bozemanensis Miller.

Platycrinus bridgerensis Miller.

Platycrinus douglassi Miller.

Rhodocrinus bozemanensis Miller.

Rhodocrinus bridgerensis Miller.

Rhodocrinus douglassi Miller.

Rusophycus montanensis Miller.

Miller assigns the strata containing these fossils to the Burlington, or Keokuk. The strata here are nearly vertical and are extremely fossiliferous. Some slabs are covered with Brachiopods and Bryozoa. Three of the new species of crinoids, *Rhodocrinus douglassi*, *R. bozemanensis* and *R. bridgerensis*, were found on one small slab.

Old Baldy Mountain. — In the 6th Annual Report of the United States Geological Survey of the Territories on pages 468–470 a list of Carboniferous fossils from Old Baldy Mountain is given, but there is no distinction of horizons. Last summer I made collections from the Madison laminated limestones on the north escarpment of the, and in the more thickly bedded limestones much higher on the southern or southeast slope of the mountain. The collections were kept separate. They were submitted to Mr. Percy E. Raymond of the Carnegie Museum who furnished lists which I give below. As stated before, the Cambrian, the lowest member of which is a quartzite, rests here on the north escarpment of the mountain, directly upon the Archæan gneiss. Above this are Cambrian shales. Above these there are limestones which are mapped on the Three Forks Folio as Cambrian and Devonian. I do not know that fossils have been found in the Devonian, but Mr. DeMors, a geologist and mining man, told me he had found Cambrian fossils here. Above these beds are the thin-bedded limestones of the Madison division of the Carboniferous. Field No. 133 came from here. I did not have time to make a large collection, and the higher beds seemed of more importance. Field Nos. 134, 136, 137 and 138 came from these upper beds. In the latter besides a considerable invertebrate fauna there are fragmentary vertebrate remains (principally fish teeth, etc.), which have not been studied. I copy below Mr. Raymond's lists with his opinions as to horizons.

⁶ I am not certain, but think the locality of one of these species of *Poteriocrinus* has been wrongly assigned and was found at Logan.

"Old Baldy, head of Alder Gulch, Montana, Field No. 133.

Favosites sp. ind.

Platycrinus sp. ind.

Fenestella sp.

Pholopora sp.

Productus gallatinensis Girty.

Productus lævicosta White.

Athyris lamellosa L'Eveillé.

Proëtus peroccidens Hall and Whitfield.

Spirifer centronatus Winchell.

"Three of these species: *Productus gallatinensis*, *P. lævicosta* and *Proëtus peroccidens* are among the commonest species of the Madison limestone of the Yellowstone National Park, and may be considered as characteristic of the Mississippian, though *Productus gallatinensis* has been found in the Hermosa formation (Pennsylvanian) of Colorado. *Athyris lamellosa*, though rare in the Madison limestone, seems to be confined to the Mississippian. *Spirifer centronatus* is a characteristic Lower Carboniferous form.

"Baldy Mountain, Montana, Field No. 134.

Productus cora d'Orbigny.

Productus sp.

Spiriferina spinosa Norwood and Pratten.

Hustedia mormoni Marcou.

Myalina cuneiformis Gurley.

Cleiothyris sp.

Athyris sp.

Proëtus cf. *P. peroccidens*.

"Judging from the presence of *Hustedia mormoni*, *Productus cora* and a *Spiriferina* of the *spinosa* type, this faunule belongs to the Upper Carboniferous, though the last two species on the list are Madison forms."

Though the Nos. 134, 136, 137 and 138, were all collected in the same locality and strata it is barely possible that some might have come from a stratum a trifle lower which might make a considerable difference in age. But I think it will be found that they are all of the same horizon.

"Old Baldy. Field Nos. 136, 137, 138.

Cæleenterata.

Zaphrentis sp.

Favosites sp.

F. divergens White & Whitfield.

Syringopora sp.

Chaetetes milleporaceus Troost.

Echinodermata.

Archæocidaris sp.

Platycrinus sp.

Crinoid stems.

Bryozoa.

Prismopora sp.

Paleschara sp.

Brachiopoda.

Orthothetes sp.

Derbya crassus Meek & Hayden.

Chonetes loganensis (?) Hall & Whitfie d.

C. flemingi Norwood & Pratten.

Productus inflatus McChesney.

P. cora d'Orbigny.

P. nebraskaënsis Owen.

P. semireticulatus Martin.

Productus sp. ind.

Marginifera muricata Norwood & Pratten.

M. haydenensis Girty.

Spirifer rockymontanus Marcou.

S. striatus (?) Martin.

Spiriferina spinosa Norwood & Pratten.

Martinia sp.

Reticularia sp.

Squamularia perplexa McChesney.

Seminula subtilita Hall.

Cleiothyris orbicularis McChesney.

Hustedia mormoni Marcou.

Pugnax rockymontana Marcou.

Dielasma bovidens Morton.

Pelecypoda.

Pleurophorus sp.

Myalina sp.

M. wyomingensis Lee.

Edmondia sp.

Nucula sp.

Gastropoda.

Platyceras sp.

Strophostylus remex White.

“This fauna is plainly Upper Carboniferous (Pennsylvanian) in character, and seems to be somewhat closely related to the Hermosa formation of the San Juan region, Colorado, as described by Girty.”

Sheep Mountain. — This mountain lies to the south and west of Old Baldy Mountain. Here several years ago I found a few crinoids which were determined by Girty as *Platycrinus bozemanensis*, *Rhodocrinus douglassi* and *Actinocrinus* ? sp. This is Lower Carboniferous. Above these beds there is a considerable thickness of crystalline limestone full of links of crinoid stems and fragments of Brachiopods. I found no good fossils here. This perhaps is Upper Carboniferous.

Tobacco Root Mountains. — In the summer of 1900 Prof. E. H. Murray and myself, while collecting for the University of Montana, ascended the Tobacco Root Range and traversed about 25 miles of its crest. The rocks examined here were chiefly Carboniferous and Jurassic. Here we get the upper members of the former, which are just beneath the latter. Here the upper part of the Carboniferous is a peculiar formation principally limestone with red stains. In it there were many fossils. In one cliff near a little red lake I made a considerable collection which is now in the University of Montana. I think this is upper Carboniferous but the fossils have not been determined. It will be interesting to know what relation this fauna bears to that from the upper Carboniferous quartzites at Ziegler's Cañon, a list of which I give later. In the bedded sandstones which I found overlying the Carboniferous here there were Jurassic invertebrates and in a layer of clay were many bones of large Dinosaurs. There certainly is not any great thickness of Carboniferous quartzite here.

Snow Crest Range. — This is a high mountain ridge which has a rather unusual trend for a mountain range of this region. Its direction is north of northeast and south of southwest. Its height and sharpness and the extending of the Tertiary beds high on its western flank gives one the impression that it is a comparatively new uplift. What surprises the geologists who have examined the Palæozoic rocks of the surrounding region is the entirely different character and appearance of the rocks here. Instead of the gray, more or less brown-

stained, rather thinly stratified limestones of the Lower Carboniferous of the Bridger, Ruby, Madison, and the Tobacco Root Ranges, which are usually overlaid by gray massive or more thickly bedded limestones, we have not less than 1,500 feet of a uniformly colored black limestone with alternations of thinner and thicker strata. This is in turn overlaid by heavy quartzites. In the rock beneath this I found no fossils, but it is almost identical in appearance with the Cambrian elsewhere. There are fossiliferous strata through the entire thickness of the formation. The lists are given in Mr. Girty's communication, which is quoted farther on.

Sage Creek. — In one locality on a branch of Sage Creek which flows into Red Rock Creek below Lima a collection was made. This is where the stream has cut a ravine through a portion of the Carboniferous series. It is about twenty miles farther west than the place where the fossils were collected on the Snow Crest Range.

Rocky Mountains. — Main Divide south of Red Rock Lake. Here the Palæozoic rocks are more nearly horizontal than is usual. The mountains here stand up like a great wall or tableland. The northern part is made up of timbered slopes, slides of broken limestone, and perpendicular cliffs. The rock is in thin and thicker layers. The fossils that were found there were poor.

I now give the lists of fossils sent me by Mr. Girty with the portion of the letter which gives his views as to the horizons represented.

The following species have been identified.

1. Spring Cañon, Ruby Mountains, about fourteen miles west of Virginia City, near Laurin, Montana.

Cyathocrinus sp.

Taxocrinus sp.

Actinocrinus sp.

Platycrinus bozemanensis.

Platycrinus n. sp.

Rhodocrinus douglassi?

Rhodocrinus bozemanensis.

Poteriocrinus n. sp.

Archæocidaris sp.

Chonetes ornatus.

Chonetes loganensis.

Productus scabriculus.

Productus gallatinensis.

Cleiothyris roissyi.

Camarophoria ringens.

Platyceras sp.

2. Ruby Mountains, about fourteen miles west of Virginia City, Montana.⁷

Fucoid.

Menophyllum excavatum.

Platycrinus bozemanensis.

Platycrinus douglassi ?

Platycrinus n. sp.

Rhodocrinus bridgerensis ?

Rhodocrinus douglassi ?

Stenopora sp.

Fenestella sp. (etc.).

Leptæna rhomboidalis.

Productus scabriculus.

Spirifer centronatus.

Spiriferia solidirostris.

Seminula immatura.

Cleiothyris crassicaudalis ?

Terebratuloid shell.

Camarophoria ringens.

Camarotechia sp.

Edmondia ? sp.

Cypricardinia ? sp.

Platyceras 2 sp.

3. Mount Surprise, Snow Crest Range, near Three Forks of Ruby, Montana.

Fucoid.

Zaphrentis cf. *dalei*.

Crinoid indeterminable.

Stenopora sp.

Fenestella sp.

Productus cora.

Productus cf. *alternatus*.

Productus cf. *mesialis*.

Productus cf. *burlingtonensis*.

⁷ 1 and 2 are two collections from the same locality.

- Productus* sp.
Spirifer cf. *grimesi*.
Spirifer cf. *keokuk*.
Seminula subquadrata (and *trinuclea* ?).
Cleiothyris roissy.
Dielasma sp.
Pinna ludlowi.
Allorisma elongatum.
Edmondia cf. *warsawensis*.
Straparolius cf. *similis*.
Pleurotomaria cf. *nauvooensis*.
Naticopsis sp.
Phillipsia sp.
4. Sheep Mountain, Snow Crest Range, near Old Baldy Mountain, and about ten miles south of Virginia City, Montana.
- Platycrinus bozemanensis*.
Platycrinus douglassi ?
Actinocrinus sp.
5. Lowest fossiliferous horizon, Mt. Surprise, Snow Crest Range.
- Productus* sp.
Cleiothyris roissy.
Seminula subquadrata.
Myalina cf. *keokuk*.
- 6, Main divide of Rocky Mountains, south of Red Rock Lake.
- Zaphrentis* sp.
Orthothetes inflatus ?
Chonetes ornatus ?
Spirifer centronatus ?
Spiriferina solidirostris ?
Platyceras sp.
Euomphalus sp.
Loxonema sp.
7. Head of branch of Sage Creek, about eighteen miles south of Dillon, Montana.
- Zaphrentis* sp.
Lithostrotion ? sp.
 Crinoid stems.
Rhipidomella burlingtonensis.
Productus setigerus.

Productus gallatinensis?

Spirifer grimesi?

Spirifer forbesi?

Martinia rostrata?

Ambocælia? sp.

Seminula madisonensis var. *petilla*.

Cleiothyris roissyi.

Pugnax cf. *missouriensis*.

Dielasma turgidum?

Loxonema sp.

Pleurotomaria sp.

8. Jack Creek Cañon, Montana.

Camptonectes sp.

Two other fossils.

9. Three Fork Shales northwest of Three Forks of the Missouri, Montana.

Spirifer disjunctus.

Cleiothyris n. sp.

10. Three Fork Shales.

Spirifer disjunctus.

Cleiothyris n. sp.

Camarotoechia tethys.

Pugnax pugnus.

Goniatites (2 sp.).

“Viewing the collection in the light of present knowledge, I believe that two distinct faunas appear in those from the Carboniferous. One is the widely distributed Waverly fauna which characterizes the Madison limestone of the Yellowstone National Park and the lower part of the Wasatch limestone of Utah, and which has now been recognized in almost every western state. The lists 1 and 2 show this fauna in a very characteristic facies, though crinoids are much more abundant than they are found elsewhere. With 1 and 2 should be associated lists 4 and probably 6 and 7. The other fauna is represented by lists 3 and 5 though the latter is too scanty to be conclusive. There is little doubt but that this fauna is younger than the other. In my letter to you several years ago I referred it to the Keokuk. At present both because of its faunal characters, though they show certain affinities with Osage types, and its apparent overlap and unconformity with the Waverly beds I am inclined to believe

that it will prove to be earliest Pennsylvanian, and be equivalent to beds which in the Central and Eastern States have been variously called, now Millstone Grit, now Coal Measure conglomerate, and again the Pottsville group. As this fauna is as yet imperfectly known, my opinion is merely tentative, and the fauna from Montana may be, as I at first believed, a modification of one of the Mississippian faunas.

"(8) is Rocky Mountain Jurassic.

"(9) and (10) are evidently the same and belong to the Devonian and, I have little doubt, to the Upper Devonian."

Zeigler's Cañon, Bighole River. — This is southwest of Twin Bridges, above Zeigler's Springs. A detailed section is given on plate XV. The lowest rock exposed here is a heavy quartzite succeeded by stratified quartzites which in places contain fossils. The following list of species was supplied by Mr. Raymond.

"Lower Cañon of Bighole River, above Zeigler's Springs, Montana.

Lingula sp. ind.

Camarotoechia sp. ind.

C. metallica White.

Pugnax utah Marcou.

Productus sp. ind.

Cleiothyris orbicularis McChesney.

Aviculopecten cf. *A. weberensis* Hall and Whitfield.

Aviculopecten cf. *A. utahensis* Meek.

"An Upper Carboniferous faunule."

PERMIAN?

In the Zeigler's Cañon section, the Upper Carboniferous quartzites are overlaid by shales, apparently carbonaceous, with layers of limestone, and then by 150 feet or more of thin bedded limestones with layers of shales. The limestone weathers to a uniform chocolate brown on the surface. Interbedded with these are dark slates. These limestones and slates are very fossiliferous but the fossils are mostly of one species, a *Lingula*. These beds occur also in the Frying-Pan Basin west of Dillon. I have not seen them in any other places.

Some of these fossils with other sets were sent to T. W. Stanton of the United States Geological Survey. The following is his report on them.

"Lower Bighole Cañon, below Zeigler's Springs, Montana.

Lingula.

Aviculopecten.

Myalina.

"These lots are evidently from the series called 'Permo-Carboniferous' by the Fortieth Parallel Survey, Utah, where it is well developed.

"The fauna has not been thoroughly studied, but it is probably Permian. In southeastern Idaho the beds containing it immediately underlie the Trias."

About 400 feet above the beds containing the Permian fossils are red shale, or clay and sandstone, in which a few fragments of bone, portions of turtle shells, etc., were found. These were too fragmentary to be determinable. Above this is a band of fifteen or twenty feet of limestone in which a few fossils were found. These were examined by Professor Stanton who reported on them as follows:

"Jurassic? Cañon of Bighole River, above Zeigler's Springs, Montana.

Unio sp. Imperfect young specimen of same type as *U. douglassi*.

Neritina sp.

Goniobasis ? sp. Form with carinate whorls.

Goniobasis ? sp. Form with rounded whorls.

"These fossils are not sufficient to determine the age of the beds, but they seem to me more recent than Jurassic. Weed obtained similar fossils from above the Cascade formation (Kootenai) in beds that he mapped as Dakota on the Fort Benton Sheet."

In the cañon of Jack Creek which flows into the Madison River below Ennis, in the Madison Mountains in a thick-bedded, compact, dark-colored limestone a few fossils were found which were also examined by Professor Stanton. They are the following:

"*Gryphaea planoconvexa* Whitfield.

Ostrea engelmanni Meek? Fragment may be a large Lima or Pecten.

Comptonectes bellistriatus Meek.

Comptonectes pertenuistriatus Hall & Whitfield.

Pleuromya subcompressa Meek.

"These species belong to the ordinary Marine Jurassic fauna of Montana and the Yellowstone National Park."

For description of the locality and geological section see 6th Annual Report, U. S. Geol. Survey of Territories, p. 162.

On the top of the Tobacco Root Mountains north of Black Butte

the Jurassic is very well exposed. Here, as stated before, it lies upon the Carboniferous. In one place on the eastern slope just below the crest of the range a little stream issuing from a spring in a swampy place has washed out bones of large Dinosaurs. Those exposed are water-worn. In the sandstones I found some poor invertebrate fossils.

LOWER CRETACEOUS?

Near Drummond in Granite County, in a compact greenish-brown rock, I found some fossil ferns resembling *Pecopteris* and leaves that look like *Sterculia*, which are probably lower Cretaceous, but they have not been determined and nothing definite can be said concerning the age. They may prove to be Kootenai.

DAKOTA.

In the various Montana Atlas folios and geological maps of Montana, strata have been mapped as doubtfully Dakota on the evidence of the position of the beds but in none of them had characteristic fossils been found. For the most part the formation mapped as Dakota contains a heavy band of limestone which is very fossiliferous, containing, wherever exposed, great numbers of bivalves and gasteropods.

In the Jack Creek (Jackass on the map) Cañon in the strata mapped as Dakota on the Three Forks Atlas Sheet, I collected fossil leaves. Part of these are in the University of Montana and the remainder in the Carnegie Museum. The latter were sent to Professor F. H. Knowlton, who determined the following:

Sequoia reichenbachii?

Quercus primordialis.

Laurus protæfolia.

Ficus lanceolata acuminata.

These are all Dakota species. The leaves came from layers of sandstone in sandy clay. Above, but, according to A. C. Peale lower geologically, is a considerable thickness of gray sandstone. This is probably the horizon which Peale says contains fragments of fossil leaves.⁸ The lithological character of the rocks here is nothing like that of the beds which contain so many gasteropods, etc., in other places.

⁸ Sixth Ann. Report, U. S. Geol. Surv. of Terr., p. 163.

DAKOTA?

In several places beside those mapped by the United States Geological Survey, I have observed limestones containing non-marine mollusca lying between Jurassic and upper Cretaceous strata. These are well exposed on the lower Bighole River north of Zeigler's Cañon, in the Frying-Pan Basin northwest of Dillon, on the west slope of the Tobacco Root Range, etc. A small collection of the fossils from Zeigler's Cañon was sent to Professor Stanton. The following is his report:

Field No. 131, north side of Bighole, southeast of McCarty's Mountain above Zeigler's Cañon, Montana.

Unio sp. Slender form of the type of *U. douglassi*.

Corbula sp. Very abundant. Doubtfully referred to *Corbula*.

Possibly two species.

Goniobasis ? sp. Very slender, smooth form.

Goniobasis increbescens Stanton.

Viviparus ? sp.

"This collection is from the horizon probably doubtfully referred to the Dakota in the Yellowstone region. Its age is very doubtful."

Field No. 132. — From a higher horizon at same locality as 131.

Unio sp. Differs from one in lot 131.

Goniobasis ? *increbescens* Stanton.

Fish teeth, etc.

"This lot probably belongs to the same horizon as 131."

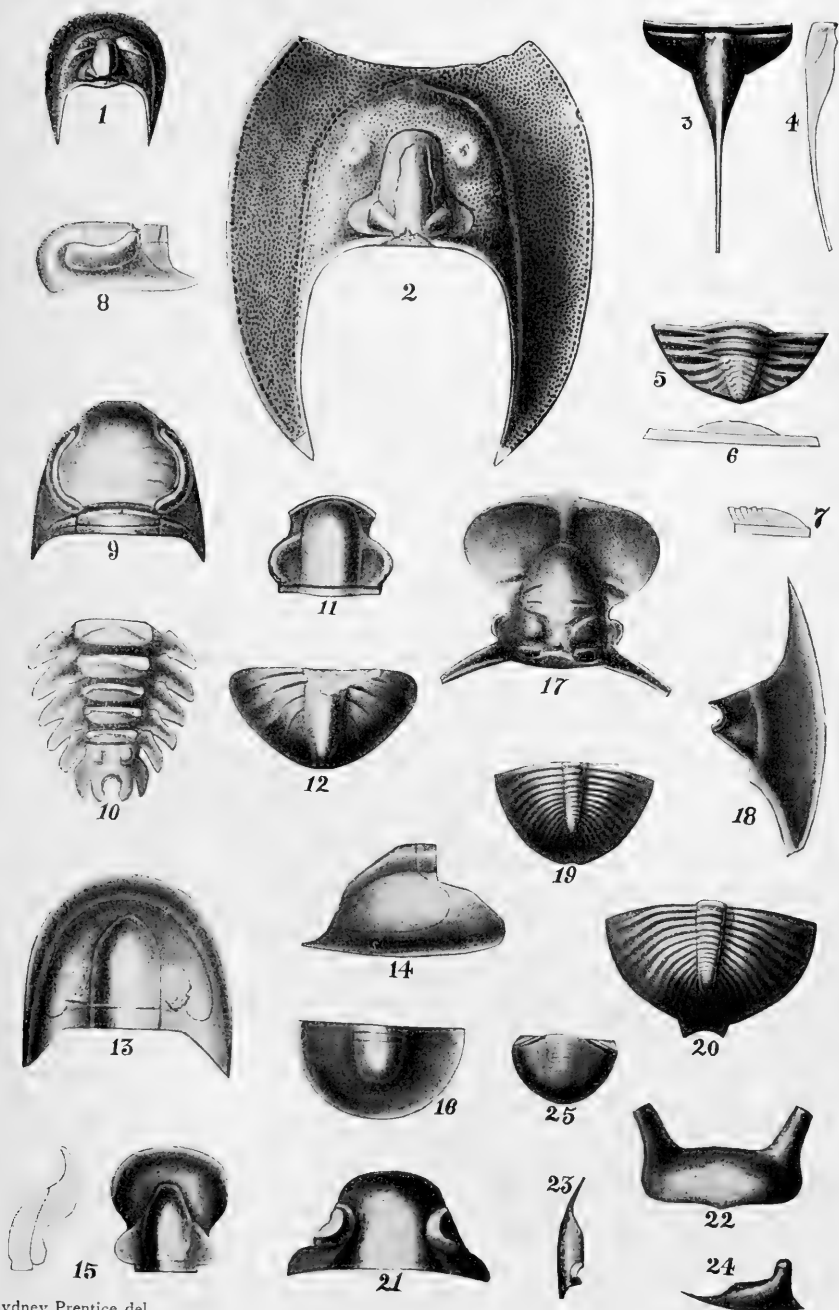
DESCRIPTION OF PLATE.

A-B. A Palæozoic section on Camp Creek east of Melrose, Montana. The section extends from *A* down the creek south of west to *B*, where Carboniferous limestones form the western flank of the mountains along the Bighole valley.

C-D. A section about fifteen miles to the southward of *A-B* and a little farther east. This is nearly supplementary to the Camp Creek section, though there are undoubtedly some strata lost between the two.

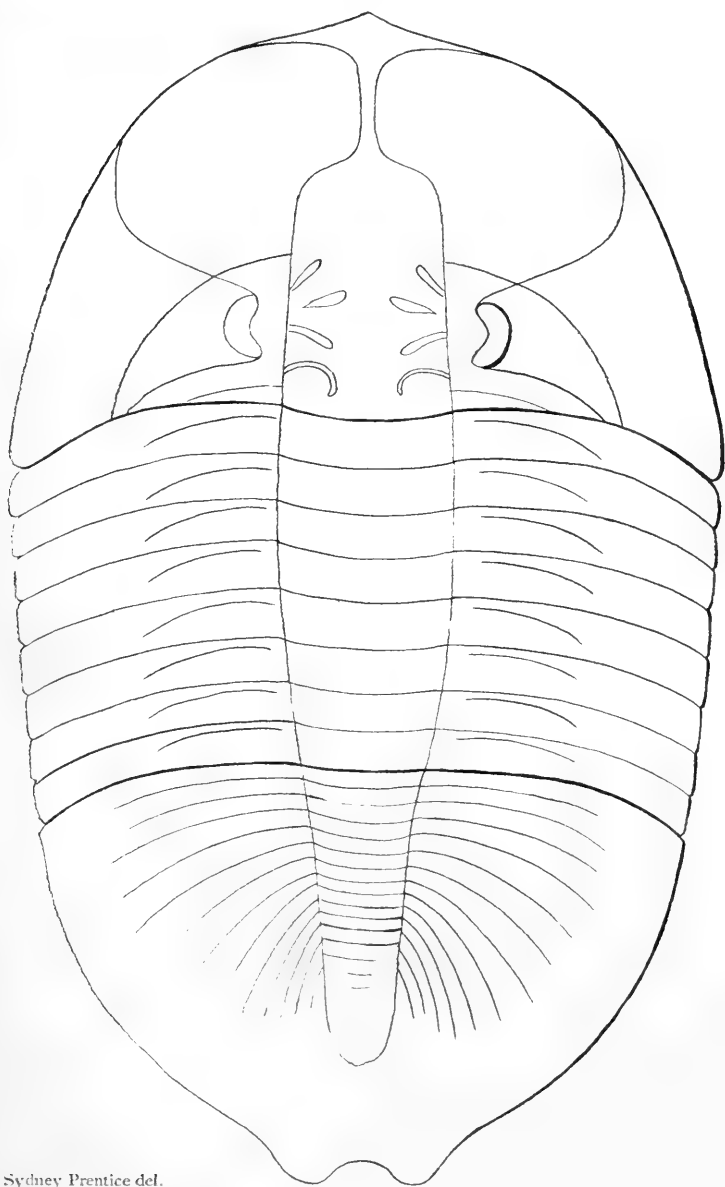
This section extends from above Zeigler's Springs up the Bighole from east to west. It begins with heavy Carboniferous quartzite. The upper portion of the quartzites contain Upper Carboniferous fossils. This is succeeded by Permian?, possibly Triassic, Jurassic and then Cretaceous strata. Then by a fault the Carboniferous quartzites come in again, overlying the Mesozoic and dipping at the same angle. Above this the strata are repeated and continue up through Cretaceous to Laramie and ending in McCarty's Mountain in what may be Livingston or later.

This region presents a most beautiful study in dynamic geology, as the strata are so plainly exposed. A mile north of here the section would be quite different.



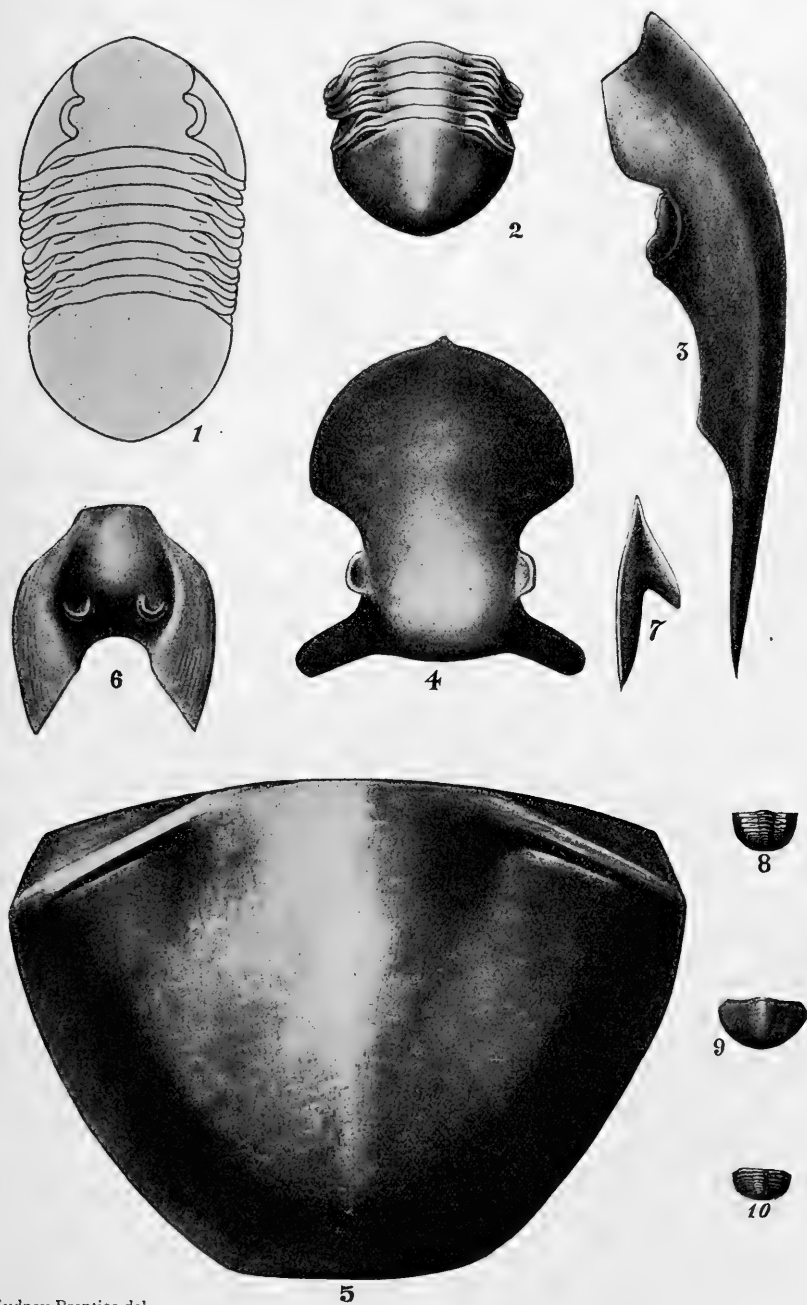
Sydney Prentice del.

Trilobites from the Chazy Limestone.



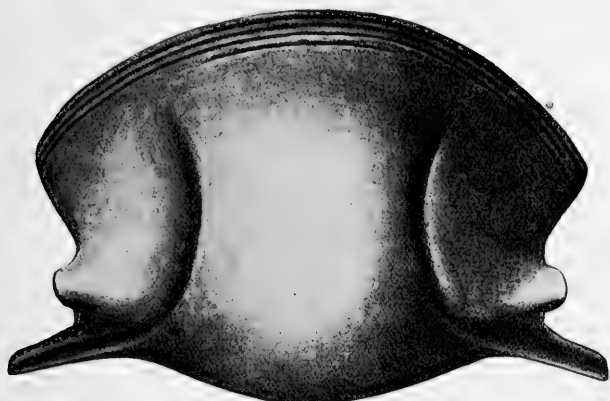
Sydney Prentice del.

Trilobites from the Chazy Limestone.



Sydney Prentice del.

Trilobites from the Chazy Limestone.



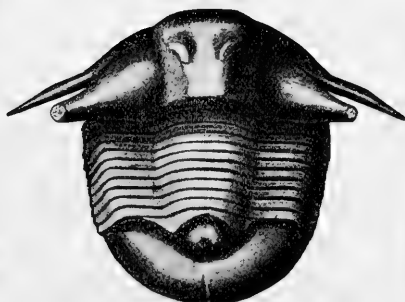
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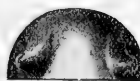
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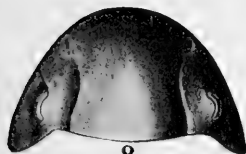
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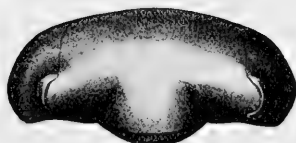
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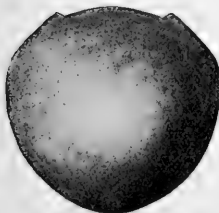
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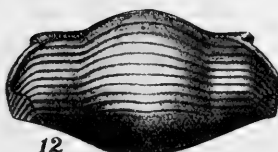
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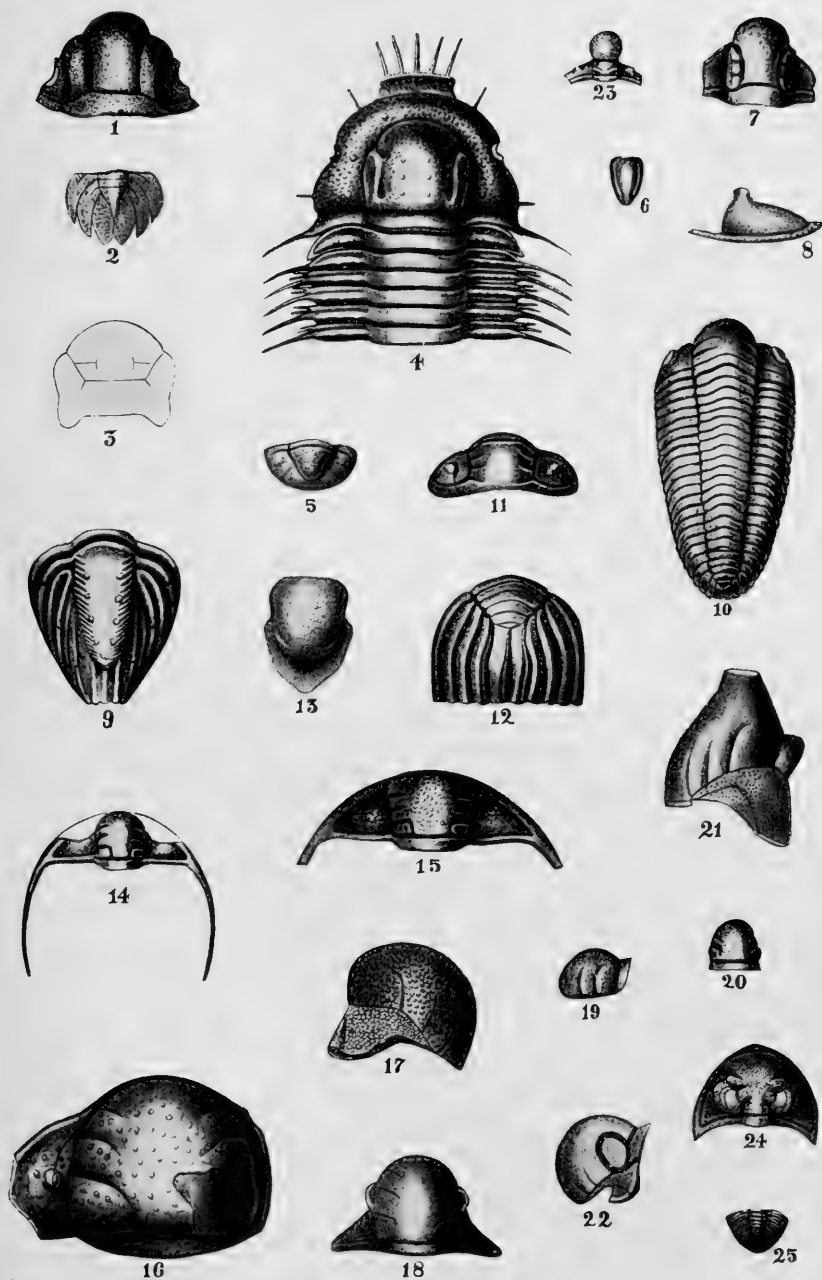
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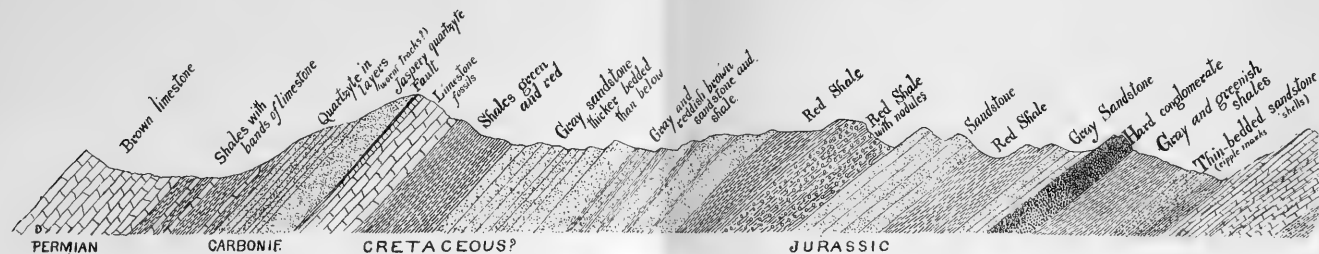
Sydney Prentice del.

Trilobites from the Chazy Limestone.



Sydney Prentice del.

Trilobites from the Chazy Limestone.



Geological Section of Paleozoic Rocks on Camp Creek, A-B. Geological Section of Paleozoic and Mesozoic Rocks on Big Hole River, C-D.

thorough illustration of this difficult group. We are with pleasant anticipation awaiting the time when the remaining sections of Mr. Godman's intended gift shall come into our possession, and the work of systematically arranging the lepidoptera of the two Americas can be undertaken at the Carnegie Museum.

THE collection of birds belonging to Sir Walter L. Buller, K.C.M.G., F.R.S., the distinguished author of the "History of the Birds of New Zealand," has been acquired by the Carnegie Museum. A number of the species represented in this collection are known already to be extinct, and others are rapidly verging upon extinction. Such a collection as this will never again be made. Gould's birds of Australia are in the possession of the Academy of Natural Sciences of Philadelphia; Buller's birds of New Zealand are now the property of the Museum in Pittsburgh. It is a rather singular coincidence that these two great collections from the antipodes should both have found a final resting place upon the soil of Pennsylvania.

THE Trustees of the British Museum with great kindness have authorized the presentation to the Carnegie Museum of a number of important restorations of original material in their possession, which will add very much to the interest of the paleontological collections of the Carnegie Museum.

FROM Mr. Alfred N. Leeds of Peterborough, England, we have purchased a skull of *Rhinoceros antiquitatis* found by him in a gravel pit. The skull is in a remarkably perfect state of preservation. There was a time in England when the rhinoceros and the hyena were as common in that country as until recently they were in the vicinity of the Cape of Good Hope.

THREE parties from the Museum are at present making paleontological explorations in the West. Mr. O. A. Peterson assisted by Mr. Olcott and Dr. Hermann are at work in Sioux county, Nebraska, and report encouraging progress. Mr. W. H. Utterback is at work in the Jurassic of Wyoming and has been quite successful in securing valuable material. Mr. Earl Douglass and Mr. Percy E. Raymond are systematically making explorations in Montana.

MR. HUGO KAHL accompanied by Mr. Klages have been engaged for some time in making entomological collections in the vicinity of Ohio Pyle.



View of the Superior Surface of the Skull of *Goniopholis Gilmorei* Holland.
 $\frac{4}{10}$ nat. size. The portions marked + have been restored.

IX. A NEW CROCODILE FROM THE JURASSIC OF WYOMING.

By W. J. HOLLAND, LL.D.

In the summer of the year 1902 Mr. C. W. Gilmore, at that time in the service of the Carnegie Museum as a field collector, succeeded in finding in the Freeze Out Mountains, not far from the "T. B. Ranch," a number of interesting fossils, among them the skull of a crocodile, which the writer provisionally refers to the genus *Goniopholis* Owen,¹ and to which he applies a specific name in honor of the discoverer. The geological horizon from which this skull came is that known as the Atlantosaurus Beds, and the skull was found in a stratum about eight inches above a stratum in which were found commingled remains of dinosaurs belonging to the genera *Morosaurus* and *Dipiodocus*.

Class **REPTILIA.**

Order. *LORICATA* Merrem.

Suborder *EUSUCHIA* Huxley.

Family *GONIOPHOLIDIDÆ* Lydekker.

Genus **Goniopholis** Owen.

Goniopholis? gilmorei sp. nov.

(Catalogue of Vertebrate Fossils, Carnegie Museum, No. 1339.)

The specimen consists of a skull without the lower jaws. It has been subjected to vertical pressure and is evidently somewhat crushed, so that the transverse dimensions, more particularly in the neighborhood of the orbital and postorbital openings, are greater than they would have been in life and the perpendicular dimensions are less. Otherwise the skull is remarkably well preserved. The entire upper surface is covered with round or angular pits from 2 to 3 mm. in diameter, with intervals of about $1-1\frac{1}{2}$ mm. between them, formed by convex reticularly arranged ridges of the bone, in this respect agreeing perfectly with the generic description given by Owen.

The premaxillaries have not sustained much crushing; the anterior

¹ See *Report of the Eleventh Meeting of the British Association for the Advancement of Science*, page 71.

edge has been broken, and the margin of these bones is not entire. A portion of the posterior margin of the right dental foramen is, however, preserved, showing that the animal possessed the dental foramina, and thus was allied to the genus *Crocodylus* rather than to the genus *Alligator* Cuvier, or the genus *Gavialis* Oppel, the former of which is characterized by the absence of the dental foramina, except possibly in extreme age, and the latter of which is always without these openings. The foveæ on the lower surface of the intermaxillaries which lead from the orifices of the dental foramina are distinctly marked on the under surface of the skull. The snout is strongly constricted at the point where the premaxillaries unite with the maxillaries at the dental incisure. The nasal bones do not reach the narial opening, their anterior ends terminating between the premaxillaries fully three centimeters from the posterior margin of this opening. The alveolar border of the maxillaries extends backward from the point of union with the premaxillaries, in a widening curve, to a point in advance of the orbital cavities. There does not appear to be much, if any, evidence of lateral compression of the skull about the middle of the maxillaries, as is the case in the skull of many species of recent crocodiles, notably *Crocodylus Americanus* Seba. The distortion of the specimen to which the skull has been subjected as the result of vertical pressure may have slightly obliterated the evidence of constriction at the point indicated, in case it existed in life.

The arrangement of the bones composing the roof of the back part of the skull is essentially like that in the recent genus *Crocodylus*. At the point where the mastoid and the parietal bone form the inner and posterior margins of the supratemporal fossæ there are developed well marked convex bony ridges, rising about four mm. in height above the plane of the upper surface of the bones which have been named. This bony ridge is far more strongly marked than in the recent genus *Crocodylus*, where it exists only as a vestige. In other respects the upper surface of the skull shows no points of difference from modern types. The under surface of the specimen preserves, though greatly crushed, the outlines of the bones of the inferior surface of the skull, and these do not seem to diverge in form and arrangement from well known recent types.

With the skull were associated a few teeth. The alveolar border of the maxillaries and premaxillaries is sufficiently perfect to show that the number of teeth was identical with that of the modern genus

Crocodilus, and the arrangement of the teeth and their relative sizes, so far as it is possible to ascertain the facts from the skull under consideration, was the same as in *Crocodilus*. Three successional teeth are preserved on the left hand side of the upper jaw, and the crowns of two larger teeth were found detached from the skull and in the matrix beside it, evidently belonging to the same specimen. These teeth differ somewhat from those of the recent genus *Crocodilus* in being somewhat more compressed and trenchant and not as conical. They are not, however, as obtuse as the teeth described by Owen as belonging to the genus *Goniopholis*, although upon the crown, particularly upon the inner surface, they distinctly reveal the neatly defined longitudinal ridges, which appear to agree with the description given by Owen. The two lateral ridges, one anterior and the other posterior, midway between the convex and concave surfaces, are in both cases sharply defined, and even more sharply than in the genus *Crocodilus*. The larger of the teeth that have been preserved appears to the writer to be, reckoning from the front, No. 10 in the left series.

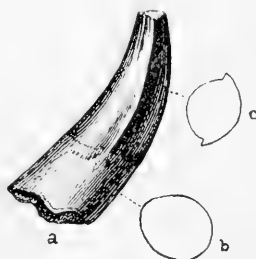


FIG. 1. *a*, Tooth of *G. Gilmorei*, nat. size; *b*, outline of section at base; *c*, outline of section at middle of crown.

DIMENSIONS OF THE SKULL OF GILMORE'S CROCODILE.

| | |
|---|-----------|
| Length of skull on median line..... | 38.50 cm. |
| “ “ “ from posterior extremity of quadrate to end of snout..... | 44.50 “ |
| Transverse diameter of snout across premaxillaries | 7.20 “ |
| “ “ “ “ at junction of maxillaries and premaxillaries | 4.00 “ |
| “ “ “ skull at front of orbits..... | 10.80 “ |
| “ “ “ “ at upper ends of mastoids | 12.00 “ |
| “ “ “ “ at end of quadrates..... | 20.00 “ |
| Longitudinal diameter of left orbital foramen | 4.00 “ |
| Transverse “ “ “ “ “ | 5.20 “ |
| Longitudinal “ “ “ postorbital foramen | 4.50 “ |
| Transverse “ “ “ “ “ | 3.50 “ |
| Diameter of supratemporal foramen..... | 4.00 “ |

The specific characters by which this species may be distinguished from the other species of the genus *Goniopholis* described from North America appear to be the very closely pitted superior surface of the bones of the skull, the existence of the elevated ridges partly sur-

rounding the supratemporal foramina, and the less obtuse, elongated, and compressed shape of the teeth.

The writer assigns the species to the genus *Goniopholis* with doubt: first, because no vertebræ were collected, and therefore it is unknown whether the centra were amphiœlous as in *Goniopholis* or not; and, secondly, because the longer, less obtuse, and more trenchant teeth do not fully accord with the generic description given by Owen.

X. PROCAMBARUS, A NEW SUBGENUS OF THE GENUS CAMBARUS.

BY A. E. ORTMANN, PH.D.

In a paper just published (*Proc. Amer. Phil. Soc.*, vol. 44, 1905, p. 91), the present writer has divided the genus *Cambarus* into four subgenera: *Cambarus* (*sens. strict.*), *Cambarellus*, *Faxonius*, and *Bartoni*us. The first of these (*Cambarus*) is framed to receive the first and second group of this genus, as distinguished by Faxon (excluding *C. pellucidus*, which I refer to *Faxonius*).

In the paper referred to (p. 99), the writer has indicated, that the association of Faxon's first and second group into one subgenus might possibly not be entirely correct, but, that a division according to the number of legs which possess hooks on the ischiopodite, as introduced by Faxon, does not exactly correspond to the natural affinities. He also pointed out, that possibly the shape of the copulatory organs of the males of certain Mexican and Cuban species is more important in this respect.

The Carnegie Museum has lately purchased from Professor J. S. Hine, Columbus, O., a number of specimens of a new species of *Cambarus* from Guatemala (Acc. No. 2778; Cat. Nos. 74,560 and 74,561), belonging in this group, which, in the paper referred to, has been designated as the *digueti*-group (of the section of *C. digueti*), containing hitherto three species (*digueti*, *mexicanus*, *cubensis*). An examination of the copulatory organs of this new form, and their comparison with the figures of these organs of *C. carinatus*, = *digueti* and *cubensis*, with the description of these organs in *C. mexicanus*, and with a male cotype of *C. digueti*, kindly presented by Professor E. Bouvier, of Paris, has led to the conclusion, that all these species, as well as the new one to be described herein, possess a type of male copulatory organs, which is quite peculiar, and differs considerably from that seen in other species of the subgenus *Cambarus* (type: *C. blandingi*).

The description of this organ, as given by Faxon for his first and second groups, and by the present writer for the subgenus *Cambarus*, does not apply at all to these Central American and Cuban species.

An attempt has been made, in the paper referred to, to also include these forms in *Cambarus*, but, as is now evident, this is impossible. The material at hand when the paper was written was too poor (only one male of the second form of *C. digueti*) to decide the question, and, moreover, the description of these organs in *C. mexicanus* was not well understood, since no figure had been published.

However, Faxon's description of the male organs of *C. mexicanus* suddenly became clear to me when I compared it with the new species, and plainly these organs in these two species are very similar. Since good figures of those of the other two species have been published, it is now possible to give a correct account of these organs, and to point out their chief peculiarities.

Faxon's description of the male copulatory organs in his first and second group is as follows: "*Outer part truncate at the tip, and furnished with one to three small recurved teeth; inner part terminated by a short acute spine, which is generally directed outward.*"

For the subgenus *Cambarus*, I have given the following characters of the male organs: "*Sexual organs of male stout, more or less straight, and comparatively short, truncated or blunt at the tip, the outer part ending in one to three horny teeth, which are sometimes recurved, or compressed, or plate-like, and are always sharply distinguishable by means of the blunt end. Inner part terminated by a shorter or longer acute spine, which is sometimes distinct from the tip of this part, so that it appears two-pointed.*"

This latter description was framed with the desire to make it fit the species of the *digueti*-group; but it neglects the fact, that in these species the outer part of the male organs does not possess any horny teeth, as is generally the case in species of the type of *blandingi*. In the species of the *digueti*-group, it is the *inner* part that possesses, in the male of the first form, a single horny spine, which has a variable position in the different species, but is always highly characteristic for one and the same species. It has taken me some time to ascertain this fact; indeed, I admit that I may be mistaken in so far as that there is a remote possibility that this horny spine belongs to the outer part, since in the new species to be described here, its position is just at the point where the two parts (inner and outer) become distinguishable at the anterior margin of the organ; but after examining the condition in second form males of the new species and of *C. digueti*, I feel rather sure that this accessory tip, which is not horny and spiniform

in this case, but tuberculiform, belongs to the inner part. (Compare also Faxon's figure of *C. carinatus* = *digueti*, Proc. U. S. Mus. 20, 1898, pl. 63, f. 2.)

Thus this organ is fundamentally different from that of the subgenus *Cambarus* as represented by its type (*C. blandingi*), and, moreover, it possesses at its anterior margin, not far from the tip, a peculiar angular projection, which I have called the "shoulder." Such a shoulder is found in a few cases in other species belonging to the subgenus *Cambarus* (*C. clarki* and *troglydites*), and in numerous species of the subgenus *Faxonius* (section of *C. propinquus*); but here it always has a different position, being quite remote from the tip of this organ.

Thus I think we are justified in emphasizing this peculiar feature of the male organs by creating for it a separate subgenus, for which the name *Procambarus* is proposed, and we consequently have now *five* subgenera within the genus. The diagnoses of the two first are as follows.

Procambarus subgen. nov.

Sexual organs of male stout, more or less straight and comparatively short, rather blunt at the end, but not truncate. The two parts in close opposition up to the tips. The outer one ending bluntly, without horny teeth; the inner one being more or less similar to the outer one, but possessing in various positions one horny spine. Anterior margin with a shoulder near the tips. In the male the third pereopods have hooks.

Species: *digueti*, *williamsoni*, *mexicanus*, *cubensis*.

Cambarus (Ortmann *sens. restrict*).

Sexual organs of male stout, more or less straight and comparatively short, very blunt, or truncated at the end. The two parts in close opposition, with exception of the terminal spines. The outer part ending in one to three horny teeth, which are often recurved, or compressed, or plate-like, being sharply distinguishable from the blunt end. Inner part terminated by a shorter, or longer, acute spine. A shoulder on the anterior margin is rarely present, and it is, if present, quite remote from the tip. In the male the third, or the third and fourth, pereopods have hooks.

The diagnoses of the other three subgenera: *Cambarellus*, *Faxonius*, *Bartonius*, do not require any change.

Thus, from my subgenus *Cambarus*, certain species are removed as the subgenus *Procambarus*, which would belong to Faxon's second group: but not the whole of Faxon's second group belongs to *Procambarus*, since the other species, which I have designated (*l. c.*) as the *simulans*-group and the section of *C. gracilis*, possess sexual organs that entirely correspond to those of the section of *C. blandingi*. In the subgenus *Cambarus*, consequently, three sections remain:

Section of C. simulans:

Male with hooks on third pereiopods. Areola rather narrow, but never obliterated in the middle, slightly longer than half of the anterior section of the carapace. Chelæ elongated and subcylindrical.

Species: *simulans*, *gallinas*.

Section of C. gracilis:

Male with hooks on third pereiopods. Areola obliterated in the middle, considerably longer than half of the anterior section of carapace. Chelæ short, broad, ovate.

Species: *gracilis*, *hagenianus*, *advena*.

Section of C. blandingi:

Male with hooks on third and fourth pereiopods. Areola wide, or narrow, rarely obliterated in the middle, shorter, or longer. Chelæ generally elongated, narrow and subcylindrical.

Divided into four groups, containing together about 15 species.

The species of the subgenus *Procambarus* are easily distinguished by the following characters:

- a_1 . Inner face of male sexual organs flattened, but not broadly dilated.
 - b_1 . Sexual organs of male slightly curved backward at apex; horny spine of inner part straight, situated posterior to the tip of the outer part. Rostrum carinated above. Carapace with one lateral spine on each side.
 - C. (Procambarus) digueti* Bouvier.
 - b_2 . Sexual organs of male straight; horny spine of inner part curved, situated anterior to the tip of outer part. Rostrum not carinated above.
 - c_1 . Rostrum with marginal spines. Carapace with two lateral spines on each side.
 - C. (Procambarus) williamsoni* spec. nov.
 - c_2 . Rostrum without marginal spines. Carapace without marginal spines.
 - C. (Procambarus) mexicanus* Erichson.
- a_2 . Inner face of male sexual organs flattened and greatly dilated, forming a broad, flat, setose plate. Rostrum not carinated, with marginal spines. Carapace without lateral spines.
 - C. (Procambarus) cubensis* Erichson.

DESCRIPTION OF NEW SPECIES.

CAMBARUS (PROCAMBARUS) WILLIAMSONI spec. nov.

Diagnosis. — Male sexual organs with the outer part blunt, the inner slightly longer than the outer, narrower, but blunt; in the first form with a horny, procurved spine at the anterior margin, which is represented by a blunt tubercle in the male of the second form. The inner face of inner part slightly dilated and flattened, with two rows of bristles diverging from a low oblique rib. Rostrum with distinct lateral spines, acumen short; its upper surface subplane, without keel. Sides of carapace granulated, with two spines on each side behind the cervical groove. Areola very narrow, about half as long as the anterior section of the carapace. Chelæ long, subcylindrical, thickly squamose-granulated, the granulations larger on inner side of the carpopodite and hand, only in young specimens with an indistinct spine. Finger shorter than the palm. Third pair of pereopods with hooks in the male.

Description of Male of First Form. — Rostrum subplane, without median keel, margins slightly elevated, convergent, with a distinct lateral spine on each side a short distance from the tip. Acumen short, triangular, with a fringe of stiff hairs. Postorbital ridges divergent posteriorly, ending in a small spine anteriorly. Carapace laterally compressed, suborbital angle rounded. Branchiostegal spine distinct. Sides of carapace finely, but distinctly granulated; two sharp lateral spines on each side behind the cervical groove. Areola about half as long as the anterior section of carapace, including the rostrum, very narrow in the middle, with a single irregular row of punctations. Abdomen as broad as, and slightly longer than, carapace; epimera rounded; anterior section of telson with two spines on each side. Anterior end of epistoma broadly triangular. Antenna with the flagellum longer than the carapace, but shorter than the whole body. Antennal scale broad, broadest in the middle. Chelæ subcylindrical, long, thickly beset with squamiform granulations, which are largest on the inner side. Fingers not gaping, shorter than palm, granulated, and indistinctly longitudinally costate on upper side; slightly pubescent at the cutting edges, and with a few longer hairs. Carpopodite without sulcus above, granulated like hand, granules largest on inner side, but not spiniform (with exception of young specimens, where there is a small spine at the distal end of inner margin). Meropodite

granulated, almost smooth on proximal parts of outer and inner side, with a small spine near distal end above. Lower side with two rows of spiniform granulations, most distinct in young individuals. Ischiopodite of the *third pair of pereopods* with a strong hook. *Copulatory organs* (first pair of abdominal appendages) short and straight, with a

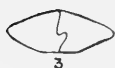


FIG. 1. Male copulatory organ of right side seen from outside. FIG. 2. Male copulatory organ of right side seen from inside. FIG. 3. Annulus ventralis of female. All figures enlarged twelve diameters.

prominent shoulder on the anterior margin near the tip. Outer and inner part in close apposition to their tips; outer part ending bluntly, the inner slightly longer and thinner, but also blunt. The inner part carries, at its anterior side, not far from the shoulder, a small, procurved, horny spine. Inner face of inner part flattened, and slightly dilated, with two rows of bristles, which diverge from a low, oblique median rib.

The male of the second form differs in the less distinctly granulated carapace; the chelæ are weaker; the hooks of the third pereopods smaller; the copulatory organs are similar, but the horny, procurved spine is replaced by a blunt tubercle that is not horny. (This gives the whole organ three blunt tips.)

Female: Similar to the male of the second form. *Annulus ventralis* transversely rhomboid, forming a simple tuberculiform elevation, with an S-shaped longitudinal fissure, but without any depressions.

Locality: Los Amates, Province of Izabal, Guatemala. In small streams and swales. January 20, 1905; collected by E. B. Williamson, of Bluffton, Ind. (About 4 to 5 miles due south of the town of Izabal, south of Rio Malagua.)

There are 27 specimens in the lot, 13 ♂, 14 ♀. Only one (the largest) is a male of the first form. Most of the specimens are very young.

The *measurements* of the largest ♂ (I) and ♀ are as follows:

♂. Total length 51.5 mm., carapace 25 mm., anterior section of carapace 16.5 mm., areola 8.5 mm., width of areola in the middle 0.5 mm., abdomen 26.5 mm., length of hand 20 mm., of palm 11 mm., of fingers 9 mm.

♀. Total length 49.5 mm., carapace 24.5 mm., anterior section of carapace 16 mm., areola 8.5 mm., width of areola in the middle 0.5

mm., abdomen, 25 mm., length of hand 13 mm., of palm 7 mm., of fingers 6 mm.

The specific name is given in honor of the discoverer, Mr. E. B. Williamson. Before Mr. Williamson started for Guatemala, I called his attention to the possible presence of a *Cambarus* in this country, and his search was rewarded by the discovery of this species.

REMARKS ON THE GEOGRAPHICAL DISTRIBUTION.

The existence of a *Cambarus* in Guatemala (Coban, Alta Vera Paz) was first mentioned by Huxley (1878), but the species has never been described. It remains doubtful whether the present species is the same, since it comes from another part of the country, although both localities belong to the Atlantic slope.

Cambarus williamsoni is sharply distinguished from all other species of the genus, although it forms a natural group (subgenus *Procambarus*) with three other species, two of which are found in Mexico (*digueti*, *mexicanus*), and the third in Cuba (*cubensis*). The most closely allied form is *C. mexicanus*, but this is apparently more highly specialized, as is shown by the lack of the marginal spines of the rostrum and the lateral spines of the carapace. Thus *C. williamsoni* is to be regarded as a rather primitive form, and stands between *C. digueti* and *C. mexicanus*. I have regarded *C. digueti* as the most primitive form of the whole genus; but second to it is *C. williamsoni*. *C. mexicanus* comes very close to the latter, while *C. cubensis* is more remote from the rest on account of the broadly dilated inner face of the male organs; but the beginning of the development of this feature is clearly indicated in the other three species.

Thus it is beyond doubt, that *C. cubensis* points in its affinities to Guatemala and Mexico, and our Guatemalan species indicates the way by which Cuba was populated. In my paper referred to (*Proc. Am. Phil. Soc.*, 49, 1905), I have already assumed this connection on the map, without knowing anything of the existence of *C. williamsoni*, and this assumption has been fully confirmed by the discovery of this species.

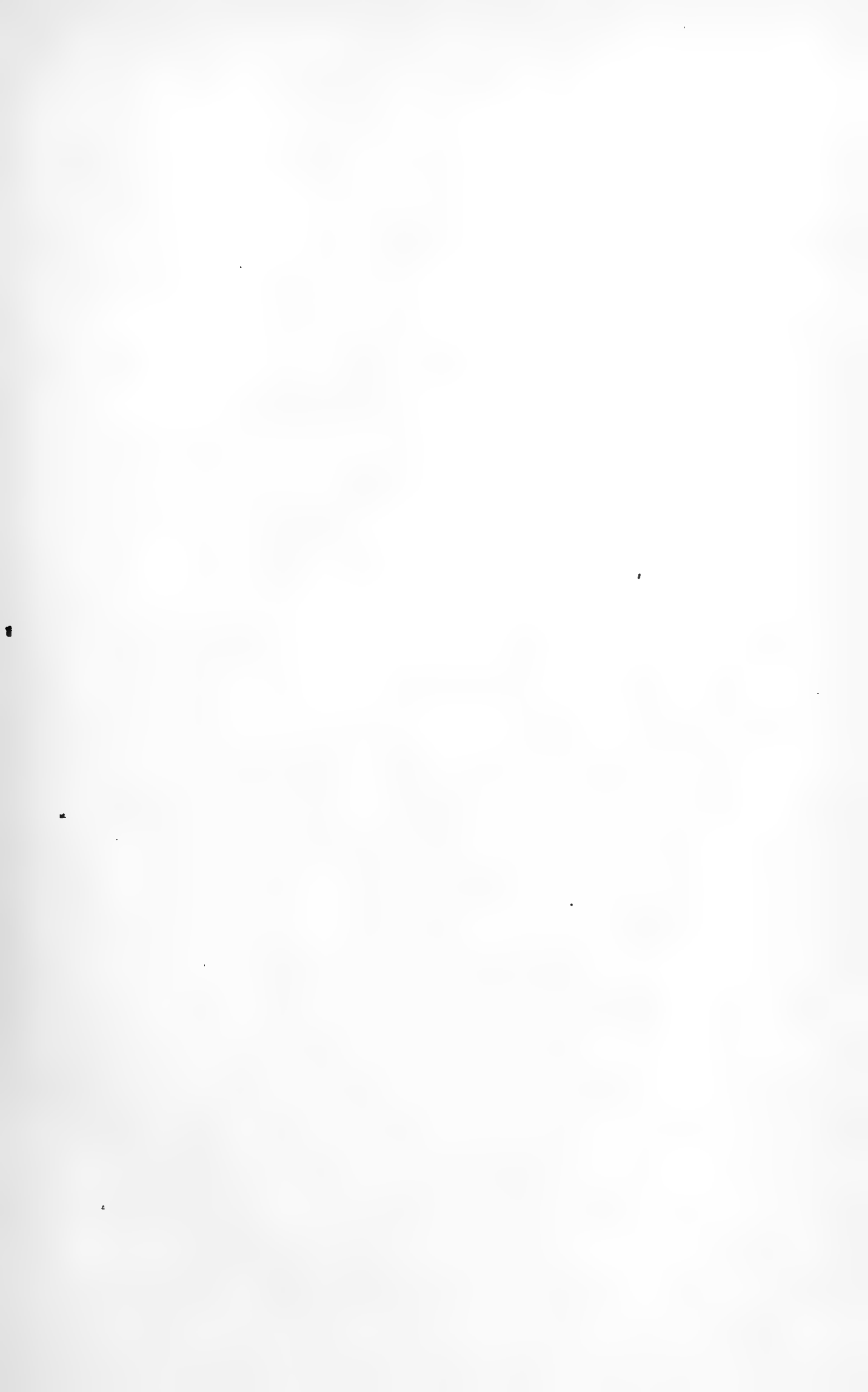
The subgenus *Procambarus* appears to be the earliest type of the genus, and its range is in the original home of the genus (Mexico and Guatemala), with the exception of *C. cubensis*, which apparently is an early emigrant.

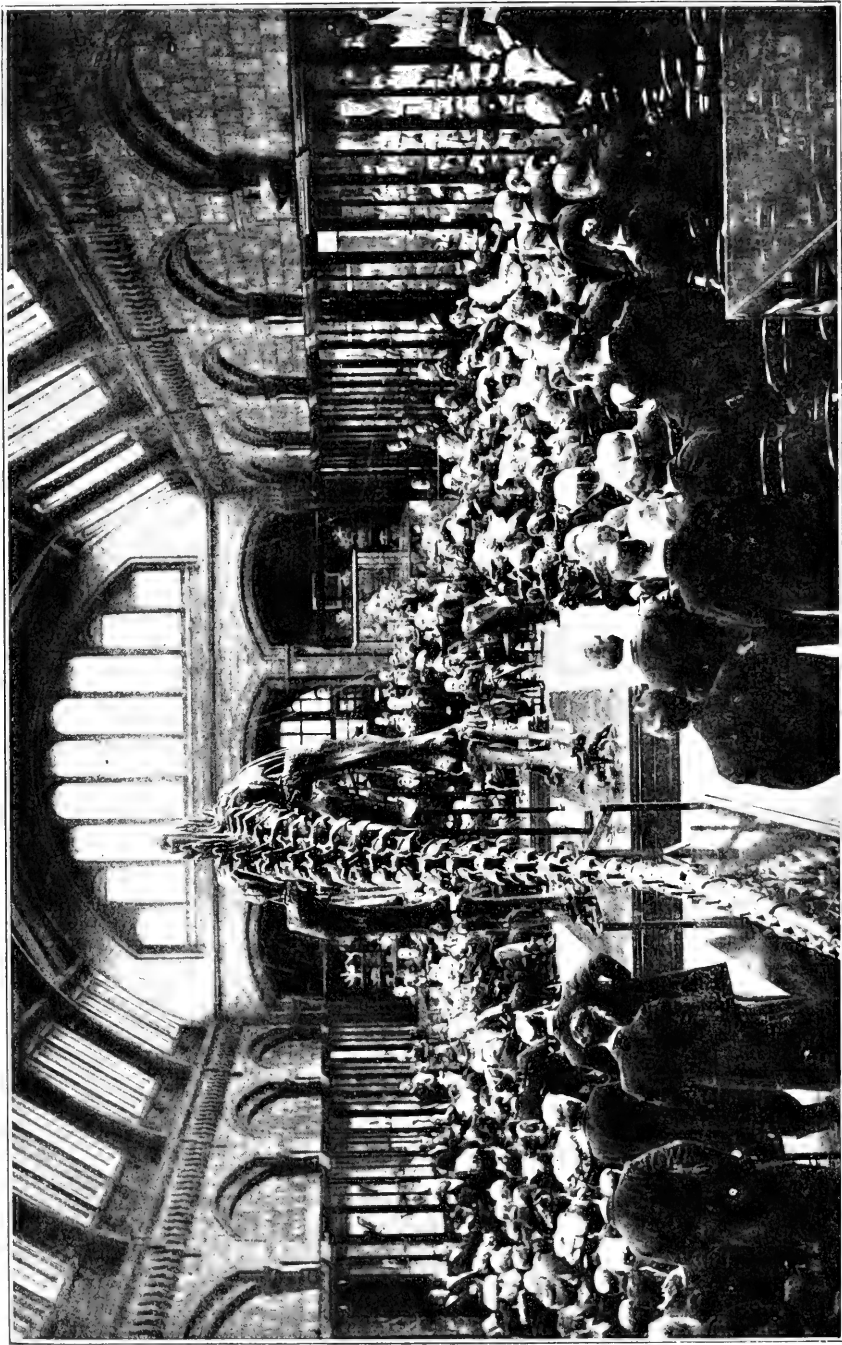
The separation of the subgenus *Procambarus* from the rest of the

genus, chiefly from the typical subgenus *Cambarus*, renders the Mexican crayfish-fauna rather peculiar. In Mexico, two well known subgenera are represented: *Procambarus* and *Cambarellus*. The first one has no representatives at all in the United States, while *Cambarellus* has only one (in Louisiana). There remains a Mexican species, *C. wiegmanni*, which has been placed with species of the true subgenus *Cambarus*, but its position is quite uncertain, the male copulatory organs being unknown.

CARNEGIE MUSEUM,

June 10, 1905.





Presentation of the Reproduction of the Skeleton of *Diplodocus Carnegiei* in the Gallery of Reptiles at the British Museum (Natural History), May 12, 1905. Lord Avebury addressing the audience.

XI. THE PRESENTATION OF A REPRODUCTION OF DIPLODOCUS CARNEGIEI TO THE TRUSTEES OF THE BRITISH MUSEUM.

In January, 1905, a reproduction of the skeleton of *Diplodocus carnegiei*, which had been made at the Carnegie Museum, under the supervision of the late John B. Hatcher, Curator of Paleontology, and, after his death, under the supervision of Dr. W. J. Holland, Director of the Museum, was forwarded to the Director of the British Museum, (Natural History). In April the Director of the Carnegie Museum, accompanied by Mr. Arthur S. Coggeshall, the Chief Preparator in the Section of Paleontology, arrived at South Kensington and immediately undertook the work of setting up the reproduction upon the bases which had been prepared. Arrangements were made by the Trustees of the British Museum for a formal presentation, to take place on May 12. Invitations were extended to the leading men of science throughout the United Kingdom to be present. At one o'clock on May 12, a distinguished company assembled in the Gallery of Reptiles. The persons present were :

Mr. H. A. Allen, Major Austin Anderson, Mr. W. J. Anderson, Dr. Charles W. Andrews, Miss A. E. Anzolato, Mr. G. J. Arrow, Mr. E. E. Austen, Lord and Lady Avebury, Mr. E. G. Baker, Sir Robert S. Ball, F.R.S., Mr. Frank Bather, Dr. F. A. Bather, Mr. Max Beerbohm, Lord Belhaven and Stenton, Mr. F. J. Bell, H. M. Bernard, Esq., James Bertram, Esq., Mr. S. Bewsher, Col. C. T. Bingham, Sir Alex. R. Binnie, Miss C. Birley, Augustine Birrell, Esq., K.C., Mr. V. H. and Mrs. Blackman, the Rev. J. F. Blake, Mr. W. T. Blandford, F.R.S., Prof. T. G. Bonney, F.R.S., J. L. Bonhote, Esq., Mr. G. A. Boulenger, F.R.S., G. S. Boulger, Esq., T. W. Bridge, F.R.S., Mr. J. Britten, Mr. T. Brock, R.A., Mr. T. Craig Brown, Col. D. Bruce, F.R.S., Dr. Ernest A. T. W. Budge, the Rev. R. Ashington Bullen, Dr. A. G. Butler, Dr. W. T. Calman, Mr. and Mrs. Andrew Carnegie, J. R. Carter, Rt. Hon. Jos. Chamberlain, M.P., Mr. J. F. Cheetham, M.P., Sir William Church, Col. G. Earl Church, John Cleave, Esq., I.S.O., E. A. Clodd, Esq., Mr. A. S. Coggeshall, Sidney Colvin, Esq., Sir Martin Conway, T. A. Cook, Esq., C. T. Cornish, Mr. G. C. Crick, Sir William Crookes, F.R.S.,

Miss Margaret Crosfield, Charles Dawson, Esq., Mrs. Delbanco, W. L. Distant, Esq., Sir Robert K. Douglas, H. E. Dresser, Esq., Hamilton H. Druce, Esq., F.L.S., Herbert Druce, Esq., F.L.S., the Earl of Ducie, Mr. Alfred East, R.A., R. H. Elmendorf, Esq., Mr. and Mrs. C. E. Fagan, Prof. J. B. Farmer, F.R.S., Captain A. Mostyn Field, R.N., H. Haviland Field, Esq., Dr. J. S. Flatt, Mr. L. Fletcher, F.R.S., Sir Walter Foster, M.P., Sir Henry Fowler, G.C.S.I., M.P., Mr. C. G. Gahan, Dr. R. Garnett, C.B., Prof. E. J. Garwood, Sir Archibald Geikie, F.R.S., Mr. A. Gepp, Lieut. Col. H. H. Godwin-Austen, Mr. W. R. Ogilvie Grant, Dr. A. C. Haddon, F.R.S., Sir George F. and Lady Hampson, Miss Hanssen, Mr. J. W. Harmer, F. W. Harmer, Esq., Dr. and Mrs. E. Hartert, Mr. W. H. Helm, Mr. F. A. Heron, Prof. S. J. Hickson, D.Sc., F.R.S., Mr. W. H. R. Holl, John Hopkinson, Esq., E. Howarth, F.R.A.S., F.L.S., J. A. Howe, Esq., Dr. W. E. Hoyle, W. H. Huddleston, Esq., F.R.S., Rev. H. N. Hutchinson and Mrs. Hutchinson, Captain F. W. Hutton, F.R.S., J. F. Isaac, B. Daydon Jackson, Esq., Sir Richard Jebb, M.P., and Lady Jebb, Sir Harry H. Johnston, Prof. J. W. Judd, C.B., F.R.S., Dr. J. Scott Keltie, Hon. Wilson King, Mrs. King, W. F. Kirby, F.L.S., Sir John Kirk, K.C.B., Mr. R. Kirkpatrick, Dr. F. L. Kitchin, H. R. Knipe, Esq., W. D. Lang, Prof. E. Ray Lankester, F.R.S., and Miss Lankester, Dr. J. Larmor, F.R.S., Arthur Lawrence, Esq., Alfred N. Leeds, Esq., and Mrs. Leeds, Thomas Leighton, Esq., Lord Lovat, C.B., C.V.O., D.S.O., the Countess of Lovelace, the Misses Lubbock, R. Lydekker, F.R.S., Miss McGillivray, Sir George Mackenzie, K.C.M.G., C.B., Dr. C. J. Forsyth Major, Sir Clements Markham, K.C.B., F.R.S., E. G. B. Meade-Waldo, Esq., Prof. R. Meldola, F.R.S., Dr. H. R. Mill and Mrs. Mill, Lady Mary Milbanke, Mr. John G. Millais, Miss Milne-Home, Dr. and Mrs. P. Chalmers Mitchell, Bishop Mitchinson, D.C.L., Sir Alfred Moloney, K.C.B., and Lady Moloney, Miss Gladys Moloney, Dr. Frederic Moore, Rt. Hon. John Morley, Mrs. A. R. Moro, Mr. George Murray, F.R.S., Admiral Sir Leopold McClintock, Mr. Bedford McNeill, E. T. Newton, Esq., F.R.S., Mr. R. Bullen Newton, Dr. E. A. Nilson, Baron Nopsca, Miss Oakley, Mr. F. Grant Ogilvie, Dr. F. and Mrs. Penrose, Mr. George Henry Perkins, Mrs. Paul L. F. Perkins, Mr. H. Plowman, R. I. Pocock, Esq., and Mrs. Pocock, Prof. E. B. Poulton, F.R.S., and Mrs. Poulton, Sir Richard Douglas Powell, Bart., K.C.V., A. Pringle, Esq., Mr. G. T. Prior, W. P. Pycraft, Esq.,

Mr. E. T. Reed, Mr. C. T. Regan, Dr. A. B. Rendle, Sir Arthur W. Rücker, F.R.S., F. W. Rudler, Esq., I.S.O., Mr. W. Radcliffe Saunders, Dr. R. F. Scharff, W. Schaus, Esq., Dr. P. L. Slater, Dr. D. H. Scott, F.R.S., Mr. F. C. Selous, Dr. David Sharp, F.R.S., Miss Emily Bowdler Sharpe, Dr. and Mrs. R. Bowdler Sharpe, Prof. Dr. W. Napier Shaw, F.R.S., Lady Sinclair, E. A. Smith, I.S.O., Mr. G. T. Herbert Smith, Sir Thomas Smith, Bart., K.C.V.O., Mr. L. J. Spencer, the Rev. T. R. R. Stebbing, F.R.S., W. P. D. Stebbing, Esq., Prof. C. Stewart, F.R.S., Major General Stirling, Sir Benjamin Stone, M.P., A. Strahan, Esq., F.R.S., Col. C. Swinhoe, Mr. J. T. Taylor, I.S.O., F. V. Theobald, Esq., Mr. Oldfield Thomas, Prof. D'Arcy W. Thompson, C.B., Sir E. Maunde Thompson, K.C.B., H. Yates Thompson, Esq., and Mrs. Thompson, Prof. W. A. Tilden, V.P.R.S., Sir George Trevelyan, Bart., LL.D., D.C.L., C. W. Wadsworth, Rowland Ward, Mr. C. O. Waterhouse, E. A. Waterbury, Esq., Mr. Wilfred Mark Webb, Prof. W. F. R. Weldon, F.R.S., Mr. H. S. Wellcome, Admiral Sir W. J. L. Wharton, K.C.B., F.R.S., Miss Whitfield, A. F. Wiener, Esq., Dr. E. A. Wilson, Captain D. Wilson Barker, Rt. Hon. Lord Windsor, the Rev. H. H. Winwood, Miss Alice Woodward, Dr. Arthur Smith Woodward, F.R.S., and Mrs. Woodward, Mr. B. B. Woodward, Miss Gertrude Woodward, Dr. Henry Woodward, F.R.S., and Mrs. Woodward, Mr. R. C. Wroughton.

The ceremony was introduced by Professor E. Ray Lankester, the Director, who said,

“My Lords, Ladies, and Gentlemen :

“Through the kindness of Mr. Andrew Carnegie we are about to receive to-day as his gift to this Museum a restoration of the skeleton of the colossal reptile *Diplodocus*. When the question of finding a place for this interesting specimen arose we resolved that instead of attempting to put it into the Hall of Paleontology, which is already greatly crowded, we would place it in the Gallery of Reptiles.

“In conversation with Mr. Carnegie on one occasion he pointed out to me that all the great progress that has been made in the American Republic has been founded upon ideas, which have germinated, and inventions, which have been really conceived, in England. The American form of government is an unfolding of British thought ; the great mechanical triumphs of American manufacturers have been

based upon inventions made in England, which they have perfected ; and I may even say that the Diplodocus is an improved and enlarged American form of an English creature, for we have recently discovered in the Oxford clays a specimen of a huge dinosaur not quite as large as the Diplodocus, but in a measure a rival. (Laughter.) You will find the remains of this creature in the Hall of Paleontology.

“I take pleasure in prefacing the occasion by reading a letter addressed to Dr. Holland, Mr. Carnegie’s representative, by command of His Majesty the King :

“ ‘ BUCKINGHAM PALACE,

“ ‘ 26 April, 1905.

“ ‘ Sir :

“ ‘ I have had the honour of submitting to the King your letter respecting the Skeleton of the Reptile which Mr. Carnegie has sent to London for the Natural History Museum.

“ ‘ I am commanded by the King in reply to request you to thank Mr. Carnegie for his kind compliance with the wish which he expressed regarding the disposal of the specimen, and to say that His Majesty would be much obliged to you if you would have the goodness to cause it to be handed over to the Trustees of the British Museum.

“ ‘ I am, Sir,

“ ‘ Your obedient Servant,

“ ‘ KNOLLYS.’ ”

Mr. Lankester then said : “I now have the pleasure of introducing Mr. Andrew Carnegie.” (Applause.)

Mr. Carnegie said :

“ *My Lords and Gentlemen, Trustees of the British Museum :*

“You will have seen from the published accounts how it comes about that this gigantic monster makes his appearance and takes up his abode among you. You owe this to one of your former Trustees, who, although no longer of your Board, I am sure retains his interest in your work unimpaired. I refer to His Majesty, who, even in his recreations, seems to keep his eyes and mind ever open for opportunities to advance the interests of his country in every department of national life, from the peace of nations to the acquisitions of your Museum. His Majesty when at Skibo expressed the hope that the Diplodocus before us might some day be seen here. It is a source of much gratification that we across the Atlantic, who owe so much to

your Museum, should be enabled thus to evince our gratitude by adding another to its innumerable attractions. It is doubly pleasing that this should come from the youngest of our Museums on the other side to yours, the parent institution of all, for certainly all those in America may be justly considered in one sense your offspring; we have followed you, inspired by your example. To our Director, Dr. Holland, we owe the discovery of the Diplodocus. He it was who suggested the annual summer holiday to our staff, which really is the hardest work of the year. He it was who conducted the first party to the Far West and organized victory. Success follows him wherever he goes. He suggested that this cast be made, and, as you well know, such was his intense interest in the task that he came over here and gave personal attention to it. He tells me that the cases which contained this duplicate and which were to be returned to Pittsburgh are not going home empty; on the contrary, some are to be filled with things valuable to our Museum of which the Trustees have duplicates. An alliance for peace seems to have been affected,—we are to exchange duplicates, and Shakespeare's words are fulfilled, when 'Distribution shall undo excess' and both still have enough. We are to enrich each other without in the least depleting ourselves, 'as one lamp lights another nor grows less.' 'This is an alliance indeed which 'blesses him that gives and him that takes.' No dangers dark and unknown lurk in this holy alliance.

"Thus you, Trustees of the old museum, and we, Trustees of the new, are jointly weaving a new tie, another link binding in closer embrace the mother and the child lands, which never should have been estranged, and which, as I see with the eye of faith which knows no doubt, are some day—some day—again to be reunited. (Applause.)

"Gentlemen, Trustees of the British Museum, I now perform one of the most pleasing acts of my life in asking your acceptance of this gift, for which, as I have before explained, you are indebted to His Majesty's abiding interest in your Institution." (Applause.)

Lord Avebury on behalf of the Trustees responded. He said :

"My colleagues have done me the honor of requesting me to accept on behalf of the Trustees and to thank Mr. Carnegie in their name for the interesting reproduction of the gigantic Diplodocus, which, at the wise suggestion of His Majesty, who takes so lively an interest in the Museum, he has been good enough to present to us.

“About three years-ago His Majesty took luncheon with Mr. Carnegie at Skibo Castle, and, being attracted by a drawing of the *Diplodocus*, which hung upon one of the walls, expressed to Mr. Carnegie a wish that this huge creature might be represented in the British Museum. In response to this suggestion by His Majesty, Mr. Carnegie generously caused a reproduction of the actual skeleton in the Carnegie Museum to be prepared. This we now see before us, and Mr. Carnegie is presenting it to us to-day. It is one more of the splendid gifts which have made his name famous for wise generosity. (Applause.)

“The name *Diplodocus* would not till a few days ago have conveyed much to most of our countrymen, but the sight of this skeleton will not fail to impress it on them. It is eighty-four feet in length—the most colossal quadruped which has yet been discovered; and it is not likely that any much larger ever existed.

“The size of the animal does not indeed necessarily add much to the interest. Some of the smallest creatures are most important and instructive; some most useful, and even indispensable; and others most destructive and even deadly. Still, size appeals to the imagination, and I doubt not that this specimen will excite the wonder and admiration of all who see it. The creature is remarkable in many ways, but what is perhaps most striking, next to the size of the body, is the relative smallness of the head. The creature had more nervous matter in its hips than in its head, which would seem to indicate that its movements must have been to a considerable extent ‘reflex.’

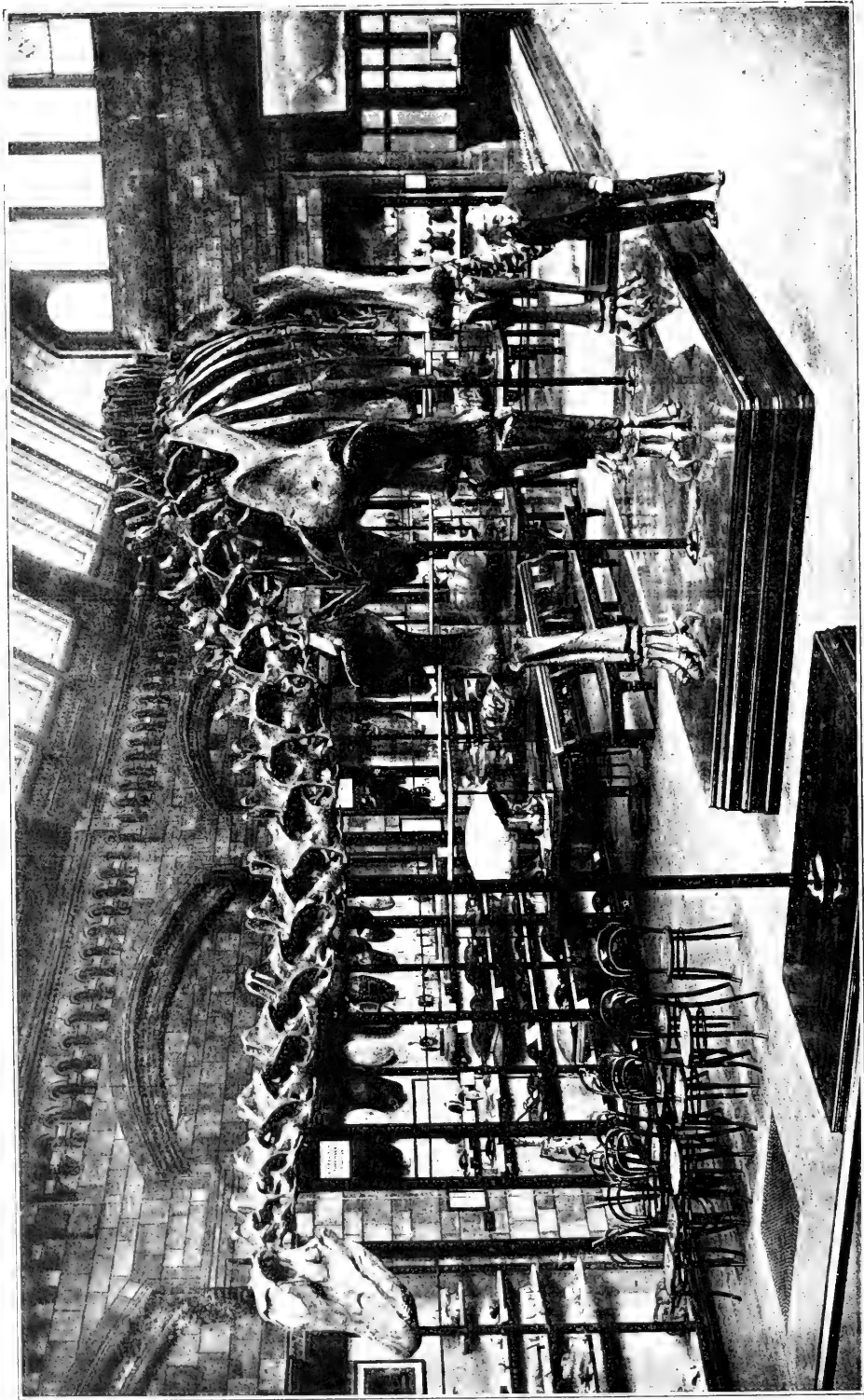
“In this colossal reproduction, of course of the natural size, every piece represents an actual bone, nothing has been left to mere scientific judgment, except, I believe—in one or two cases—the collocation of some of the parts. It is not often that remains so perfect are discovered.

“The *Diplodocus* flourished in the Jurassic period. A faint idea of its antiquity is given us by the statement that the skeleton once had 15,000 feet of sedimentary deposits over it, which have since been denuded and washed away. In fact it is certainly several millions of years old.

“Again, Mr. Carnegie, I have the pleasure of thanking you on behalf of the Trustees for this remarkable and interesting addition to our National collection. (Applause.)

“We have the pleasure of seeing here Dr. Holland, by whose efforts the original specimens were obtained and by whose skill the





Reproduction of Skeleton of *Diplodocus Carnegiei* in the Gallery of Reptiles, British Museum (Natural History), South Kensington, London.

skeleton was set up and this cast made, and I am sure it would interest us if he would be so kind as to tell us something about the discovery."

Dr. W. J. Holland, the Director of the Carnegie Museum, said :

"My Lords, Ladies, and Gentlemen :

"My good friend, Mr. Carnegie, I fear has attributed to me in his kind remarks, which you have just heard, merit which does not belong to me. I can scarcely lay claim to the discovery of the Diplodocus. The credit of first ascertaining the fact of the existence of such a creature belongs to the late lamented Professor O. C. Marsh and his assistants. Of course I do not pretend to disclaim the fact that the specimen the reproduction of which you see was obtained by myself and those associated with me. But, more than to me, to Mr. Carnegie himself, belongs the credit of the discovery. He has forgotten the laconic message addressed to me on the margin of a newspaper which he sent to me in the fall of 1898, upon which was depicted a sensational picture of a huge dinosaur, which rumor said had been discovered in Wyoming. His command, written in lead-pencil, was, 'Dear Chancellor, Buy this for Pittsburgh.' Of course I endeavored to obey him, but I will not weary you by telling you the story of the adventures which led to the discovery of the specimens, of which you see the reproduction. To Mr. Carnegie's intelligent appreciation of paleontological science and to his generosity, far more than to my humble efforts, are to be attributed the discovery, not only of this great animal, but of a multitude of other strange creatures, the remains of which we have secured for the Museum of which I have the honor to be the Director.

"We are told that Napoleon, addressing his troops just before they went into action in the Battle of the Pyramids, said to them : 'Frenchmen, remember that from yonder heights forty centuries are looking down on you.' Dr. Smith Woodward, Sir Archibald Geikie, and Sir Robert Ball, I think, will not charge me with scientific exaggeration if I say that forty thousand centuries are looking down upon us to-day from this expressionless skull. When this saurian lay down and died, nothing in all nature intimated that his bones at some future time would be resurrected by beings such as we are. Mammalian life at that time was in its infancy. Reptiles dominated the globe.

"The Diplodocus lived in the midst of tropical surroundings. When engaged in digging it up, we found near it the petrified stump of a

palm-tree. The *Diplodocus* probably lived on the soft, succulent vegetation of the shores and marshes which it haunted. The teeth tell the story. These huge beasts were simply intended to convert vegetable fiber into flesh, upon which the carnivorous dinosaurs of the time fed. On the top of the right tibia you will find the marks of teeth, showing where the bone was crunched and gnawed by a carnivorous dinosaur, and at that very spot we found the fossil tooth of one of these creatures, which had been broken off while it was engaged in feeding upon the carcass of the dead *Diplodocus*.

“The animal, the skeleton of which you see, represents only one of a number of genera and species of strange reptiles which peopled the earth in Mesozoic times. In the Hall of Dinosaurs in the Museum of the Carnegie Institute in Pittsburgh, it is our wish to assemble and display a series of skeletons representing the more striking forms of dinosaurian life. The present specimen may be regarded as a sort of first fruits of our undertaking. Such an enterprise involves the expenditure of no little labor and of much money. Fortunately, the kindness of our *Mæcenæ*, the distinguished founder and benefactor of the Institute, has never failed to provide the sinews for our scientific war.

“There are some things which I hesitate to say in Mr. Carnegie’s presence, but I cannot on this occasion refrain, as a representative of my scientific brethren in many lands, from expressing our enthusiastic admiration for the more than royal beneficence which he has in recent years displayed towards science and its votaries. His noble foundation at Washington and the even more magnificent foundation which he has created in Pittsburgh, the city in which he achieved his fortune, are destined to be enduring monuments to his liberal culture and his desire to promote truth. (Applause.)

“Now in conclusion, my lords, ladies, and gentlemen, I should be false to the promptings of my heart did I not allude tenderly and in terms of highest appreciation to the labors of Professor J. B. Hatcher, my learned colleague, who for fully eighteen months devoted himself to superintending the restoration of the object before us, but who unfortunately was stricken down in the midst of his activities by the hand of death, a premature victim to the hardships and exposures of those expeditions, which Mr. Carnegie, who always sees things from an interesting angle, has designated as ‘annual holidays.’ Mr. Hatcher was one of the most successful students of palæontology

whom America has produced. I wish also publicly to acknowledge the skill of Mr. Arthur S. Coggeshall, to whom was entrusted the mechanical execution of the restoration. To Professor Lankester, to Mr. C. E. Fagan, to Dr. Arthur Smith Woodward, and the body of gentlemen associated with them, who have in many ways aided us while engaged in the work of setting up the specimen, I desire to return on this occasion my most cordial thanks for all the courtesies which they have shown us and for the help which they have given.

“In conclusion I wish to say that it has been of the greatest benefit to me to have had the opportunity here to consult with your learned men as to the anatomy of this animal, and to find that the accuracy of our researches is in many ways confirmed by the study of the material you already possess under this roof.” (Applause.)

Lord Avebury then said, “We have the honor of having with us Sir George Trevelyan, a member of the Board of Trustees of the British Museum, who has been longer in service than any of his colleagues. I am sure we should be pleased to hear from him.” (Applause.)

Sir George Trevelyan said :

‘My Lords, Ladies, and Gentlemen :

“Although I am the oldest member of the Board of Trustees of the British Museum, I can certainly say of myself that I am the least scientific. But although I can lay no claim to special acquaintance with the sciences of geology and paleontology, I rejoice in all the advances that are being made in these and kindred sciences. I desire more particularly to express on this occasion the feeling of admiration which I am sure we all cherish for the magnificent generosity of Mr. Carnegie, another striking proof of which we have in his gift to-day to our Museum of this most interesting specimen. (Applause.)

“Mr. Carnegie is attaining one of the highest forms of happiness in conferring opportunities upon his fellowmen to acquire knowledge. He is not only providing liberally for those who possess a love of reading, but he is doing much to promote the welfare of scientific societies. In all his activity he is serving those who keep their heads above water by their self-denial, thrift, and diligence, a class which deserves best from public benefactors. The Trustees of the British Museum, while they possess two of these virtues, certainly have thrift impressed upon them by a Chancellor of the Exchequer, who grows year by year less generous. (Laughter.)

"Once again I desire on behalf of my colleagues who are the Trustees of this Museum to express our hearty thanks to Mr. Carnegie." (Applause.)

Lord Avebury then introduced Sir Archibald Geikie, F.R.S., and asked him, as representing the geologists of England, to say a few words. Sir Archibald said :

"My Lords, Ladies, and Gentlemen :

"I desire to express my great pleasure in being permitted to be here to-day to testify, as others have already done, to our appreciation of the great kindness of Mr. Carnegie.

"It is a great pleasure to us to possess this gigantic creature in the flesh (Laughter), or at least in the bone (Laughter), and to be able to study the animal in its entirety, and thus to interpret other forms, the separate and fragmentary bones of which hitherto were all that we knew, but the significance of the scattered remains of which now becomes plain to us. It is appropriate that such a monster as this should have lived on a great continent like North America. I have visited America, and I have myself traveled through some parts of the territory in which the remains of these colossal beasts are found. I know something of the wonderful resources of these regions. The men of science in America are to be envied the possession of such a wealth of inspiring material for study as surrounds them. They are making good use of their opportunities. Splendid work was done in former times by Professors Marsh and Cope, and equally fine work is being done to-day by those who are following in their footsteps. Supported by the beneficence of such a far seeing man as Mr. Carnegie, we may expect that the student of paleontology in America will achieve discoveries even surpassing in interest those which have already been made, and that, bit by bit, the wonderful story of the evolution of existing forms of life, through forms, many of them long since extinct, will be deciphered." (Applause.)

After Sir Archibald Geikie had concluded his remarks the assembly rose. The guests were presented to Mr. Carnegie, and the assembled company leisurely examined the skeleton, which appeared to create much interest in the minds of all.

XII. A LIST OF THE BIRDS COLLECTED NEAR MOMBASA, EAST AFRICA, BY WILLIAM DOHERTY.

BY W. J. HOLLAND, LL.D.

The following list is based upon a small collection of birds collected by the late William Doherty, in September and October, 1900, on the hills ten miles west of Mombasa, in British East Africa. Mr. Doherty devoted much of his time while located there to collecting lepidoptera and birds. The lepidoptera are contained in the collection of Dr. W. J. Holland. The birds were purchased by the Carnegie Museum. In a few cases, where there was doubt as to the identification of species, they were referred to Dr. Anton Reichenow of Berlin, who is universally recognized as being to-day one of the most distinguished authorities upon the avifauna of Africa. With the most obliging courtesy Dr. Reichenow determined the specimens which were sent to him, and his kindness is gratefully acknowledged. In a number of instances the species listed in this paper do not appear to have been heretofore recorded as occurring in the immediate vicinity of Mombasa.¹

For the sake of convenience the order of arrangement in the list conforms to the order of Reichenow's great work, "Die Vögel Afrikas," so far as it has appeared, and in the latter part of the list I have followed the order pursued by the same author in his work entitled "Die Vögel Deutsch-Ost-Afrikas."

Family CHARADRIIDÆ.

Genus CHARADRIUS Linnæus.

1. **Charadrius hiaticula** Linnæus.

One female, 8272.²

Genus ŒDICNEMUS Temminck.

2. **Œdicnemus capensis** Lichtenstein.

One female, 7745.

¹ In the preparation of this list I have received valuable assistance from Mr. W. E. C. Todd, Custodian of the ornithological collections in the Carnegie Museum.

² The numbers given are the catalogue numbers in the Section of Ornithology in the Carnegie Museum.

Family SCOLOPACIDÆ.

Genus NUMENIUS Brisson.

3. **Numenius phæopus** (Linnæus).

One female, 7744.

Genus TOTANUS Bechstein.

4. **Totanus glareola** (Linnæus).

Two males, 7746-7.

Genus TRINGOIDES Bonaparte.

5. **Tringoides hypoleucos** (Linnæus).

Ten males, 7748-57.

Family TURNICIDÆ.

Genus TURNIX Bonnaterre.

6. **Turnix lepurana** (Adam Smith).

One female, 7793.

Family ARDEIDÆ.

Genus HERODIAS Boie.

7. **Herodias alba** (Linnæus).

Two males, 7742-3.

Family COLUMBIDÆ.

Genus VINAGO Cuvier.

8. **Vinago wakefieldi** (Sharpe).

Three males, three females, 7764-69.

Genus TURTUR Selby.

9. **Turtur semitorquatus** (Rüppell).

Four males, three females, 7786-92.

10. **Turtur capicola damarensis** Finsch Hartlaub.

Three males, one female, 7782-5.

Genus TYMPANISTRIA Reichenbach.

11. **Tympanistria tympanistria** (Temminck).

Five males, 7777-81.

Genus CHALCOPELIA Bonaparte.

12. **Chalcopelia chalcospila** (Wagner).

Four males, three females, 7770-6.

Family PHASIANIDÆ.

Genus *FRANCOLINUS* Stephens.

13. *Francolinus coqui* (Adam Smith).
One male, 7794.

Family FALCONIDÆ.

Genus *KAUPIFALCO* Bonaparte.

14. *Kaupifalco monogrammicus* (Temminck).
Four males, 7759-62.

Genus *ASTUR* Lacépède.

15. *Astur tachiro* (Daudin).
One male, 7763.

Genus *BAZA* Hodgson.

16. *Baza verreauxi* (Lafresnaye).
One male, 7758.

Family PSITTACIDÆ.

Genus *POICEPHALUS* Swainson.

17. *Poicephalus fuscicapillus* (Verreaux Des Murs).
Two males, three females, 7795-9.

Family CUCULIDÆ.

Genus *CENTROPUS* Illiger.

18. *Centropus superciliosus* Hemprich Ehrenberg.
Four males, one female, 7804-8.

Genus *CLAMATOR* Blyth.

19. *Clamator serratus albonotatus* (Shelley).
Three males, one female, 7800-3.
20. *Clamator cafer* (Lichtenstein).
One male, one female, 7809-10.

Genus *CHRYSOCOCYX* Boie.

21. *Chrysococcyx klaasi* (Stephens).
One female, 7831.

Family INDICATORIDÆ.

Genus *INDICATOR* Vieillot.

22. *Indicator indicator* (Gmelin).
One male, one female, 7952, 8265.

23. **Indicator böhmi** Reichenow.
One female, 7953.
24. **Indicator minor** Stephens.
Five males, three females, 7811-18.

Family CAPITONIDÆ.

Genus **LYBIUS** Hermann.

25. **Lybius torquatus** Dumont.
Four males, one female, 7826-30.
26. **Lybius melanopterus** (Peters).
Two males, five females, 7819-25.

Family PICIDÆ.

Genus **DENDROMUS** Swainson.

27. **Dendromus malherbei** (Cassin).
Four males, one female, 7846-50.
28. **Dendromus chrysurus mombassicus** (Fischer Reichenow).
Four males, four females, 7838-45.
29. **Dendromus nubicus** (Gmelin).
Two males, 7851-2.

Genus **DENDROPICOS** Malherbe.

30. **Dendropicos hartlaubi** Malherbe = *zanzibari* Malherbe.
Two males, four females, 7832-7.

Family COLIIDÆ.

Genus **COLIUS** Brisson.

31. **Colius leucotis affinis** Shelley.
Four males, three females, 7853-9.

Family TROGONIDÆ.

Genus **APALODERMA** Swainson.

32. **Apaloderma narina** Stephens.
One male, adult ; one female, young, 7860-1.

Family CORACIIDÆ.

Genus **CORACIAS** Linnæus.

33. **Coracias caudatus** Linnæus.
Five males, four females, 7862-70.

Genus EURYSTOMUS Vieillot.

34. **Eurystomus afer** (Latham).
Two females, 7871-2.

Family **ALCEDINIDÆ**.

Genus HALCYON Swainson.

35. **Halcyon chelicuti** (Stanley).
Five males, two females, 7873-8; 7909.
36. **Halcyon senegaloides** Adam Smith.
Three males, two females, 7890-4.
37. **Halcyon albiventris orientalis** Peters.
Six males, adult; one male, young; four females, 7879-89.

Genus ISPIDINA Kaup.

38. **Ispidina natalensis** (Adam Smith).
One female, 7910.

Family **MEROPIDÆ**.

Genus MELITTOPHAGUS Boie

39. **Melittophagus cyanostictus** (Cabanis).
Two males, three females, 7897-7901.

Genus MEROPS Linnæus.

40. **Merops superciliosus** Linnæus.
Four males, three females, 7902-8.
41. **Merops nubicus** Gmelin.
Two females, 7895-6.

Family **UPUPIDÆ**.

Genus IRRISOR Lesson.

42. **Irrisor erythrorhynchus** (Latham.)
Two males, 7932-3.

Genus RHINOPOMASTUS (Smith) Jardine.

43. **Rhinopomastus cyanomelas** (Vieillot).
Six males, one female, 7964-70.

Family **HIRUNDINIDÆ**.

Genus HIRUNDO Linnæus.

44. **Hirundo puella** Temminck Schlegel.
One male, two females, 7911-13.

45. **Hirundo monteiri** Hartlaub.

Three males, three females, 7914-19.

Family **MUSCICAPIDÆ**.

Genus **BRADYORNIS** Adam Smith.

46. **Bradyornis pallidus** (von Müller).

Ten males, six females, 8241-3; 8245-57.

Genus **BIAS** Lesson.

47. **Bias musicus** (Vieillot).

One male, four females, 8070-74.

Genus **BATIS** Boie.

48. **Batis senegalensis** (Linnæus).

Seven males, adult; one male, young; one female, 8184-92.

Genus **PLATYSTEIRA** (Jardine) Selby.

49. **Platysteira peltata** Sundevall.

Six males, four females; one male, young, 8174-83; 8199.

Genus **TCHITREA** Lesson.

50. **Tchitrea perspicillata suaheica** (Reichenow).

Six males, three females, 8079-87.

Family **CAMPEPHAGIDÆ**.

Genus **CAMPEPHAGA** Vieillot.

51. **Campephaga nigra** Vieillot.

Seven males, five females, 8056-9; 8061-3; 8025-29.

52. **Campephaga hartlaubi** Salvadori.

Three males, 7956-57; 8054.

Family **LANIIDÆ**.

Genus **POMATORHYNCHUS** Boie.

53. **Pomatorhynchus australis minor** (Reichenow).

One male, 7990.

54. **Pomatorhynchus senegalus** (Linnæus).

Six males, one female, 7983-89.

Genus **CHLOROPHONEUS** Cabanis.

55. **Chlorophoneus quadricolor** (Cassin).

One male, 8240.

Genus LANIARIUS Vieillot.

56. **Laniarius sublacteus** (Cassin).
Three males, one female, 7982 ; 8008-10.

Genus DRYOSCOPUS Boie.

57. **Dryoscopus affinis** (Gray).
Ten males, seven females, 7991-8007.

Genus MALACONOTUS Swainson.

58. **Malaconotus olivaceus hypopyrrhus** Hartlaub.
Seven males, two females, 7971-7979.

Genus LANIUS Linnæus.

59. **Lanius caudatus** Cabanis.
One male, one female, 7980-1.

Family CORVIDÆ.

Genus CORVUS Linnæus.

60. **Corvus scapulatus** Daudin.
One male, 8173.

Family DICRURIDÆ.

Genus DICRURUS Vieillot.

61. **Dicrurus afer** (A. Lichtenstein).
Three males, one female, 8060 ; 8065-7.

Family ORIOLIDÆ.

Genus ORIOLUS Linnæus.

62. **Oriolus notatus** Peters.
Six males, six females, 7920-31.

Family STURNIDÆ.

Genus CINNYRICINCLUS Lesson.

63. **Cinnyricinclus verreauxi** ([Bocage], Finsch Hartlaub).
Two males, two females, 7954-5 ; 8023-4.

Genus SPECULIPASTOR Reichenow.

64. **Speculipastor bicolor** Reichenow.
One male, one female (?), 8270-1.

Genus LAMPROCOLIUS Sundevall.

65. **Lamprocolius melanogaster** (Swainson).
Two males, 8054-5.

Family PLOCEIDÆ.

Genus SYMPLECTES Swainson.

- 66.
- Symplectes melanoxanthus**
- (Cabanis).

Three males, one female, 7934-6 ; 8075.

- 67.
- Symplectes crocatus**
- (Hartlaub).

Two males, 7937-8.

Genus PLOCEUS Cuvier.

- 68.
- Ploceus nigriceps**
- (Layard).

Eight males, adult ; six males, young ; five females, 8030-7 ; 8043-53.

- 69.
- Ploceus aureoflavus**
- Adam Smith.

One male, 7941.

- 70.
- Ploceus bojeri**
- (Cabanis).

Five males, adult ; four males, young ; four females, 7939-40 ; 7942-4 ; 8038-42 ; 8076-8.

Genus AMBLYOSPIZA Sundevall.

- 71.
- Amblyospiza unicolor**
- (Reichenow).

One male, 7945.

- 72.
- Amblyospiza albifrons.**

Two males, adult ; three males, young ; one female, 7946-51.

Genus SPERMESTES Swainson.

- 73.
- Spermestes nigriceps**
- Cassin.

Four males ; two males, young ; two females ; three females, young, 8193-8 ; 8213-14 ; 8216 ; 8218 ; 8220.

- 74.
- Spermestes scutata**
- (Heuglin).

Three males, one female, 8211-12 ; 8215 ; 8219.

Genus ESTRILDA Strickland.

- 75.
- Estrilda astrild**
- (Linnaeus).

Three males, 8208-10.

- 76.
- Estrilda bengola**
- (Linnaeus).

Five males, three females, 8200-7.

Genus LAGONOSTICTA Cabanis.

- 77.
- Lagonosticta rhodopareia**
- (Heuglin).

Four males, 8221-24.

Genus QUELEA Reichenbach.

78. **Quelea cardinalis** (Hartlaub).
One male, young; one female, 8155-8156.
79. **Quelea erythrops** (Hartlaub).
Four males, five females, 8143-46; 8150-54.

Genus PYROMELANA Bonaparte.

80. **Pyromelana nigriventris** (Cassin).
Four males, adult; three males, young, 8157-63.
81. **Pyromelana flammiceps** (Swainson).
Seven males, adult; three males, young; five females, 8011-22; 8147-9.

Genus VIDUA Cuvier.

82. **Vidua serena** (Linnaeus).
Five males; one female, young, 8088-92; 8217.

Family FRINGILLIDÆ.

Genus PASSER Brisson.

83. **Passer swainsoni**.
Three males, one female, 8266-69.

Genus SERINUS Brehm.

84. **Serinus butyraceus** (Linnæus).
Six males, three females, 8164-72.

Family MOTACILLIDÆ.

Genus MACRONYX Swainson.

85. **Macronyx croceus** (Vieillot).
One male, 8258.

Family PYCNONOTIDÆ.

Genus ANDROPADUS Swainson.

86. **Andropadus flavescens** Hartlaub.
One male, one female, 8236-7.

Genus PHYLLOSTROPHUS Swainson.

87. **Phyllostrophus flaviventris** (Adam Smith).
One male, one female, 8238-9.

Genus PYCNONOTUS Boie.

88. **Pycnonotus layardi** Gurney.
Four males, two females, 7958-63.

Family ZOSTEROPIDÆ.

Genus ZOSTEROPS (Vigors Horsfield).

- 89.
- Zosterops flavilateralis**
- Reichenow.

Four males, 8139-42.

Family NECTARINIIDÆ.

Genus ANTHREPTES Swainson.

- 90.
- Anthreptes hypodilus**
- (Jardine).

Six males, three females, 8093-8101.

Genus CINNYRIS Cuvier.

- 91.
- Cinnyris gutturalis**
- (Linnæus).

Five males, adult; three males, young; two females, 8110;
8112-16; 8118-19; 8122-3.

- 92.
- Cinnyris acik**
- (Antinori).

Four males, one female, 8111; 8117; 8120-1; 8124.

- 93.
- Cinnyris microrhynchus**
- Shelley.

Five males, 8102-6.

Genus CHALCOMITRA Reichenbach.

- 94.
- Chalcomitra obscura ragazzii**
- Salvadori.

Three examples, 8107-9.

Family TIMELIIDÆ.

Genus CRATEROPUS Swainson.

- 95.
- Crateropus kirki**
- Sharpe.

Six males, 8259-64.

Genus ARGYA Lesson.

- 96.
- Argya rufula**
- Heuglin.

Two males, 8234-35.

Family SYLVIIDÆ.

Genus CALAMOCICHLA Sharpe.

- 97.
- Calamocichla schillingsi**
- Reichenow.

One example, 8244.

Genus CISTICOLA Kaup.

- 98.
- Cisticola aff. rufæ**
- (?), sp. nov. (?) vel.
- rufæ*
- subspecies.

Three males, three females, 8131-6.

99. **Cisticola chiniana** (Adam Smith).

Two males, 8125; 8127.

100. **Cisticola lugubris** Rüppel.

One male, 8126.

Genus CAMAROPTERA Sundevall.

101. **Camaroptera griseoviridis** (Von Müller).

Two males, 8128-9.

Genus SYLVIELLA Lafresnaye.

102. **Sylviella micrura** Rüppel.

One male, 8138.

Genus PRINIA Horsfield.

103. **Prinia mystacea** Rüppell.

One male, one female, 8130, 8137.

Family TURDIDÆ.

Genus COSSYPHA Vigors.

104. **Cossypha natalensis** Adam Smith.

Two males, 8227; 8229.

105. **Cossypha subrufescens** Bocage.

Five males, two females, 8225-6; 8228; 8230-3.

Genus ERYTHROPYGIA Adam Smith.

106. **Erythropygia quadrivirgata**.

Two males, 8068-9.

XIII. THE HYOID BONE IN *MASTODON AMERICANUS*.

BY W. J. HOLLAND, LL.D.

The Carnegie Museum, in the fall of the year 1898 obtained through the kindness of Mr. Andrew Carnegie the gift of the skeleton of a mastodon, which had been found in a peat-bog about five miles west of the village of Waterloo, in northern Indiana. The bones were carefully removed from their resting place and the skeleton was assembled by Mr. Henry Ward and his associates at that time connected with Ward's Natural Science Establishment at Rochester, New York. The specimen is, with one exception, the most perfect skeleton of a single individual of the species hitherto discovered in North America, and it is believed also to be the largest.

It is not the purpose of the writer to enter into a detailed description of the specimen, but to merely describe and figure certain bones, which, so far as he is able to ascertain, have not yet been found with similar remains, and which, therefore, possess interest. These bones are the basi-hyal, and the thyro-hyals. With these were found the styloid processes. All of these bones are remarkably well preserved.

The Styloid Processes (Fig. 1). — The left styloid has had a por-

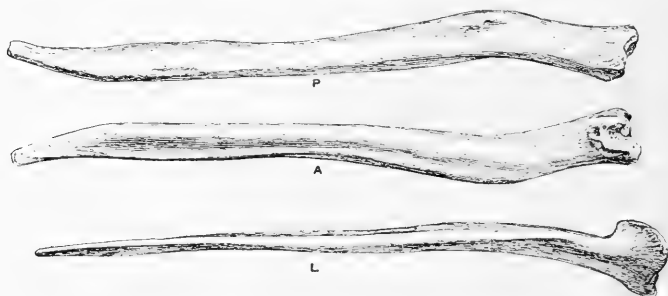


FIG. 1. Right styloid process of *Mastodon Americanus* Kerr. *P*, posterior view; *A*, anterior view; *L*, external lateral view. (Figures $\frac{1}{3}$ nat. size.)

tion of its distal extremity broken off. It is without its tip 23.50 cm. or 9.18 inches in length. The right styloid, the tip of which has not been injured, measures 24.70 cm. or nearly 9.75 inches in length. The specimen, therefore, approximately agrees in length with those

described by Warren in 1852, in his work entitled "The Mastodon Giganteus of North America," p. 13. The cranial extremities of the bones show well defined articular surfaces, the depressions and elevations in which are homologous in the bones of the left and the right hand sides. (See Fig. 2.) A layer of fibro-cartilage probably was interposed between the styloids and the *os temporis*.

The description of the styloid bones given by Warren, which applies well to the specimen before the writer, is as follows:

"The styloid processes are both perfect, measuring more than nine inches in length. They are attached at the base of the petrous portion of the temporal bones. This process is rarely seen in place; but in the head of a young elephant we find it connected with the temporal bone by a ligament. The cranial extremity of this bone, presenting the marks of the attachment of a fibro-cartilage, which intervened between it and the *os temporis*, is more than an inch across its longest diameter. From this end the bone tapers with some degree of regularity to its cervical extremity, which is pointed. The bone is curved at its upper part; and one side of the curved portion is fluted like the human clavicle, where the subclavian muscle lies under it. The texture of the bone is quite dense; for which reason it has been



FIG. 2. Articular surface of right styloid process of *Mastodon Americanus* Kerr. (Nat. size.)

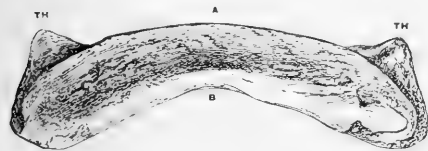


FIG. 3. Inferior view of basi-hyal bone of *Mastodon Americanus* Kerr. A, Anterior margin; B, posterior margin; TH, TH, inferior extremities of thyrohyals. ($\frac{1}{3}$ nat. size.)

preserved in a state of perfect integrity, notwithstanding the slenderness in its form."

The Basi-hyal Bone (Figs. 3, 4, 5).—The extreme length of the bone, measured at the symphyses with the thyrohyals, is 15.5 cm. The thickness at the middle is 2.5 cm. It is, roughly speaking, trian-

gular in section at the middle; anteriorly longitudinally convex, posteriorly longitudinally concave. A strongly defined, somewhat recurved ridge is developed on the anterior surface, dividing it into a superior and an inferior portion. The free surface of the upper margin between the two thyrohyals measures 7.25 cm. in length. At either end of the basi-hyal, at the points where it coössifies with the

thyro-hyals, there is evidence of the attachment of cerato-hyals, or of ligaments connecting with or having the function of these bones. They are, however, missing in the specimen.



FIG. 4. Anterior view of hyoid bone of *Mastodon Americanus* Kerr. BH, basi-hyal bone; TH, thyro-hyal bones. ($\frac{1}{3}$ nat. size.)

The Thyro-hyal Bones (Figs. 3, 4, 5). — The extreme length of these bones from their symphyses with the basi-hyal to their upper extremities is 18.75 cm. Their width at the point of union with the basi-hyal is 5.10 cm., and at the middle of the shafts is only 2.85 cm. They again widen at their upper extremities to 4.30 cm. The thickness of the shaft at the middle is only 1 cm. The bones are flattened on their outer surfaces, laterally convex inwardly, and the anterior margin near the upper extremity is twisted and flares outwardly. The anterior margin is approximately straight until near the upper end, when it curves rapidly backward. The posterior margin is gently concave. At the point of union with the basi-hyal the bone is greatly thickened.

Evidences of the usual muscular attachments are found everywhere upon the antero-superior surfaces of the bones.

The mastodon evidently was provided with powerful vocal organs,



FIG. 5. Posterior view of hyoid bone of *Mastodon Americanus* Kerr. BH, basihyal bone; TH, thyro-hyals. ($\frac{1}{3}$ nat. size.)

and at a time geologically not far remote the woodlands of North America again and again resounded to the shrill trumpetings of the mighty beasts.

ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME III. NO. 4.

EDITORIAL NOTES.

THE Director of the Museum recalls with great pleasure his recent visit to Scotland and England, during which he had the pleasure of learning much in reference to the work at present being carried on by his friends, Professor William Carmichael McIntosh, the Director of the Gatty Marine Laboratory, at St. Andrews, Scotland, and Professor D'Arcy W. Thompson, of Dundee, whose acute and valuable investigations of the marine life of the British seas have won for them very wide recognition among scientific men. During a brief stay in London, acquaintance with many scientific men was renewed, and much valuable information, especially in relation to the administrative details of museum work, was obtained.

THE various expeditions sent into the western country have returned and report most encouraging success.

Mr. O. A. Peterson, who was engaged in making investigations in the Miocene deposits of Western Nebraska, collected, and has brought to the Museum, a large amount of very valuable material. Mr. Earl Douglass and Mr. Percy E. Raymond, who spent the summer and fall in Montana, succeeded, the former in collecting many vertebrate fossils, and the latter in collecting a large number of invertebrates, and in studying the relations which the Ordovician of the west bears to that of the eastern portion of the United States. Mr. W. H. Utterback, while in northern Wyoming, succeeded in recovering a considerable portion

of a skeleton of a *Brontosaurus* and the remains of some smaller *Dinosaurs*.

THROUGH the kindness of the heirs of the late Mr. Charles S. Spang, the Museum has received the collections of Etruscan pottery and of Egyptian antiquities, which were formed by him a number of years ago. The Etruscan collection is particularly interesting and valuable. It was obtained by Mr. Spang as the result of excavations, the expense of which was defrayed by him. It contains a large number of pieces of Etruscan pottery in a beautiful state of preservation. With these collections the Museum received a number of books relating to archæology and mineralogy. Mr. Norman Spang, Esq., has deposited with the Carnegie Museum his private collection of archæological specimens, which has been very carefully made and illustrates the stone implements of the North American tribes, together with similar artifacts of the primitive races of Europe and Australasia.

DR. A. E. ORTMANN is preparing, and hopes shortly to publish in the *Memoirs of the Carnegie Museum*, an elaborate monograph upon the crawfishes of Pennsylvania, for the preparation of which he has secured a large quantity of most interesting material. He has thoroughly explored the State, and his paper will have value, not merely from the standpoint of the systematist, but from that of the student of geographical distribution.

HIS EXCELLENCY, Governor Teodoro Dehesa, of Vera Cruz, Mexico, who is well known as a student of Mexican archæology, was some years ago unfortunately robbed. In some manner a fine idol of ancient Mexican origin, which had attracted much attention, and was regarded as particularly interesting, was taken from his collection, and, after passing through many hands, was purchased by the Director of the Carnegie Museum. When its resting-place was finally made known to the Governor, a correspondence ensued, and an offer was made to restore the specimen, but his Excellency with the most engaging courtesy has requested the authorities of the Museum to accept it as a gift. Reproductions of this interesting object in facsimile have recently been made, and the Museum is prepared to exchange a limited number of these reproductions with other institutions.

IN the last number of the ANNALS, Vol. III., p. 464, the writer stated, that, so far as he was able to ascertain, certain of the bones, which he described in his paper upon "The Hyoid Bone in Mastodon Americanus," had not as yet been found or described. His attention has been called to the fact that J. D. Godman in the year 1825 published a paper, entitled "Description of the Os Hyoides of the Mastodon," which appeared in the Journal of the Academy of Natural Sciences of Philadelphia, Vol. IV., pp. 67-72, accompanied by a plate giving outlines. This paper by Mr. Godman had been entirely overlooked at the time of the publication of the paper in the Annals of the Carnegie Museum. Mr. Godman describes the basi-hyoid, which from his description and figure apparently agrees well with the specimen described by the writer, and one of the thyro-hyals. He also describes a cerato-hyal. The latter bone was not found in connection with our specimen, which, however, in all respects, aside from this, is evidently a very much more perfect specimen than the one described by Godman.

THE Trustees of the British Museum have kindly presented to the Trustees of the Carnegie Museum one hundred and sixty-five bound volumes, being the publications of the Natural History Department of the British Museum, which up to the present time have not been represented in the library of the Carnegie Museum. The Trustees and the Director of this museum desire publicly to acknowledge their great indebtedness for this signal act of generosity on the part of the authorities of the British Museum. An almost complete set of the publications of the British Museum (Natural History) is now accessible to students in the reference library of the Carnegie Museum.

EFFORTS are being made in the library of the Carnegie Museum to secure as rapidly as possible complete sets of all the publications of learned societies, to which reference must be made by students of science. The process is necessarily somewhat slow, but we hope within a few years to be able to accomplish our purpose of furnishing scientific investigators in western Pennsylvania with all the apparatus of a literary sort which they may require for the prosecution of their studies along biological lines. When this is accomplished it will no longer be necessary for students to undertake pilgrimages to

Washington, Philadelphia, New York, and Boston, in order to consult books which they must see, and thus a great impulse will be given to the prosecution of original research among the three or four millions of people who are within reach of the Institute.

THROUGH the kindness of the executors of the estate of the late Heber R. Bishop of New York a copy of the magnificent work upon Jades prepared by him and published by his executors after his death, has been presented to the library of the Museum. This sumptuous work, which is probably the most splendid set of volumes, which has thus far appeared in the twentieth century, is a gift which is greatly appreciated by the authorities of the Museum, not only because of its beauty and intrinsic value, but because of the fact that it is of the utmost practical use at the present time, for without it it would be impossible for us to do justice in description to the splendid collection of jades and jadeites belonging to the Velasco collection, upon which Mr. C. V. Hartman is at present preparing a monographic paper.

XIV. ADDITIONS AND CORRECTIONS TO THE LIST OF THE VASCULAR FLORA OF ALLEGHENY COUNTY, PA.

BY OTTO E. JENNINGS.

Since the publication in 1901 of "A Preliminary List of the Vascular Flora of Allegheny County, Pennsylvania,"¹ based mainly upon material in the Pennsylvania Herbarium of the Carnegie Museum, a considerable number of additional species have been found to occur in the County and many of these species are now represented by specimens in the Herbarium.

A critical study of more abundant, or in some cases better material, together with the examination of certain of the more difficult groups by specialists, has brought to light a few errors in identification and verified several doubtful reports. A number of the species enumerated below were based only upon "reports" in the "Preliminary List," but are now authenticated by specimens in the Herbarium collected in the County.

There are approximately 2,285 species in the vascular flora of Pennsylvania (Pteridophyta and Spermatophyta), and of this number Allegheny County now has credited to it 991 species, represented by perhaps thrice that number of carefully determined specimens collected in Allegheny County. This number is being constantly increased from the current collections of members of the Museum Staff and of various enthusiastic local collectors as well as by a critical study of older unidentified material which has in various ways come into the possession of the Museum.

In connection with many of the species mentioned in this list there are given various notes and data of locality, relative abundance, etc., such as might be of interest to local collectors.

The following species were not reported in the "Preliminary List" but have since been found to occur in the County and are now repre-

¹ Shafer, J. A., "A Preliminary List of the Vascular Flora of Allegheny County, Pennsylvania," *ANNALS CARNEGIE MUSEUM*, Vol. I., pp. 14-127, March, 1901.

sented by Allegheny County specimens in the Pennsylvania Herbarium of the Carnegie Museum :

Dryopteris spinulosa (Retzius) Kuntze.

The typical form of this species is much less common than *D. spinulosa intermedia* (Muhlenberg) Underwood, but occasionally occurs here.

Lycopodium obscurum Linnæus.

Pinus rigida Miller.

J. A. Shafer, Moon Township, near Carnot. April 25, 1904.

This species (the Pitch Pine) is now quite rare in Allegheny County, but was probably formerly quite well distributed. There are now specimens in the Herbarium from neighboring counties, Butler, Armstrong, and Westmoreland.

Eragrostis pectinacea (Michaux) Steudel.

John Ferguson, Highwood Cemetery, Allegheny City. September 12, 1889.

Triticum sativum turgidum Hackel.

The Miracle Wheat (*Triticum compositum* Linnæus) occasionally occurs as a fugitive in cultivated ground about Pittsburgh.

Carex hystricina Muhlenberg.

Mifflin Township, near Howard Street, Gustave Guttenberg. June, 1891.

Carex pedicillata (Dewey) Britton.

Carex rosea radiata Dewey.

Near Allegheny Cemetery, Pittsburgh. J. A. Shafer, July, 1884.

Leet Township, near Fair Oaks Station, Gustave Guttenberg, June 24, 1892.

Cyperus esculentus Linnæus.

Not uncommon.

Eleocharis acicularis (Linnæus) Roemer & Schultes.

Cypripedium parviflorum Salisbury.

Mollugo verticillata Linnæus.

A common weed of sidewalks, waste ground, etc., about Pittsburgh.

Ranunculus repens Linnæus.

In lawns, Forbes St., near Craft Ave., Pittsburgh. O. E. Jennings, July 27, 1904. Adventive from Europe and becoming troublesome in lawns, etc.

Aronia arbutifolia (Linnæus) Medicus.

Harrison Township, in swamp below Joseph Johnston's house,
J. A. Shafer, July 16, 1897.

Cratægus cristata Ashe.²

J. A. Shafer, "C" Roadside near S. S. Jordan's, May 16 and
October 8, 1901. Roadside near Windsor, J. A. Shafer, September,
11, 1897.

Cratægus crocata Ashe.³

J. A. Shafer, "F²" Robinson Township, near school-house,
Moon Run. May 28 and October 13, 1901. Also J. A. Shafer,
"F" Wm. Scott's field, near Beaver road, Moon Township, June
3 and October 7, 1901.

Cratægus eburnea Ashe.⁴

Type tree in Darlington Hollow, O'Hara Township, J. A.
Shafer, June 8, 1901.

Cratægus pennsylvanica Ashe.⁵

J. A. Shafer, "17 A." Type Tree is near the Fleming school-
house, Stowe Township, August 7, 1901.

A very distinct form quite common about Pittsburgh.

Cratægus porrecta Ashe.⁶

Type near the Museum, Schenley Park, Pittsburgh, J. A. Shafer,
May 27 and October 4, 1901.

Cassia medsgeri Shafer.⁷

J. A. Shafer, Allegheny County, 1900. Also John M. Milligan,
August 3, 1901.

Polygala nuttallii Torrey & Gray.**Euphorbia heterophylla** Linnæus.

Bellevue Cemetery, Allegheny City, John Ferguson, October,
1890. Escaped from cultivation.

Callitriche austini Engelmann.

Dr. W. R. Hamilton, Pittsburgh, June, 1904.

² ANNALS CARNEGIE MUSEUM, Vol. I., p. 392-3, March, 1902.

³ ANNALS CARNEGIE MUSEUM, Vol. I., p. 389, March, 1902.

⁴ ANNALS CARNEGIE MUSEUM, Vol. I., pp. 395-6, March, 1902.

⁵ ANNALS CARNEGIE MUSEUM, I., 394-5, March, 1902.

⁶ ANNALS CARNEGIE MUSEUM, I., 391, March, 1902.

⁷ *Torrey*, IV., 179-181, December, 1904.

O. E. Jennings and Grace E. Kinzer, lawn Carnegie Museum Annex, Pittsburgh, June 28, 1904.

Apparently quite common in lawns and shady places about Pittsburgh, but heretofore unnoticed on account of its minute size.

Viola tricolor Linnæus.

Occasionally escapes about buildings.

Epilobium adenocaulon Haussknecht.

The common *Epilobium* of this region. *Epilobium coloratum* Muhlenberg, elsewhere common, is here quite rare.

Aralia hispida Linnæus.

Occasional.

Thaspium trifoliatum (Linnæus) Britton.

Woods, Moon Township, J. A. Shafer, July, 1889.

Thaspium trifoliatum aureum (Nuttall) Britton.

Quite common.

Cornus alternifolia Linnæus.

Not uncommon in damp soil.

Trichostema dichotomum Linnæus.

Allegheny County, Rev. S. W. Knipe, no date.

Solanum tuberosum Linnæus.

Often met with as a fugitive and sometimes found producing seeds.

Galium asprellum Michaux.

Galinsoga parviflora hispida DeCandolle.

Common everywhere in streets, waste grounds, etc., together with the typical *Galinsoga parviflora* Cavanilles.

The following species were reported in the "Preliminary List," but at that time were not represented by specimens from Allegheny County in the Pennsylvania Herbarium of the Carnegie Museum. The species are now represented in the Pennsylvania Herbarium by specimens collected here.

Homalocenchrus virginicus (Willdenow) Britton.

Near Fleming, O. E. Jennings, August, 1904.

Panicum proliferum Lamarck.

Very common in vacant lots, etc., Pittsburgh.

Panicum virgatum Linnæus.

Not uncommon in sandy soil.

Carex crinita Lamarck.

C. C. Mellor. Swamp near P. & L. E. R. R., Robinson Township, June 21, 1889.

Carex laxiflora patulifolia (Dewey) Carey.

South Fayette Township, near Hastings, Rev. S. W. Knight, May 15, 1900.

Carex lupulina Muhlenberg.

Not uncommon.

Carex pennsylvanica Lamarck.

A common spring-flowering, hillside species.

Carex scoparia Schkuhr.

Brushton, P. R. R., C. C. Mellor, June 18, 1889.

Carex torta Boott.

Squaw Run, J. A. Shafer, April 27, 1884.

Cyperus strigosus Linnæus.

Haight's Run, Pittsburgh, J. A. Shafer, May, 1883.

Salix alba Linnæus.

Coleman's Run, Pittsburgh, Gustave Guttenberg, May 3, 1885,
Originally from Europe, but is apparently becoming locally naturalized.

Salix cordata Muhlenberg.

Not uncommon.

Salix fragilis Linnæus.

Salt-works, Twenty-third Ward, Pittsburgh, Gustave Guttenberg,
May 11, 1895.

Fumaria officinalis Linnæus.

Adventive from Europe.

Arabis glabra (Linnæus) Bernhardt.

Ross Station, O'Hara Township, C. C. Mellor, July 16, 1885.

Fragaria virginiana Duchesne.

Not uncommon.

Lespedeza procumbens Michaux.

Not uncommon.

Meibomia canadensis (Linnæus) Kuntze.

Six-Mile Island, O'Hara Township, S. N. Rhoades, August 9,
1898.

Trifolium procumbens Linnæus.

Riverview Park, Allegheny City, Grace E. Kinzer, September, 1902.

Oxalis cymosa Small.

Apparently not uncommon.

Hypericum ascyron Linnæus.

Logan's Ferry, Rev. S. Knipe, July 16, 1869.

Helianthemum canadense (Linnæus) Michaux.

Ross Station, W. P. R. R., Rev. S. W. Knipe, July, 1869.

Viola cucullata Aiton.

Occasional in moist situations.

Viola hastata Michaux.**Phlox paniculata** Linnæus.

Rather common. Escaped from cultivation.

Mentha arvensis Linnæus.

Bank of the Allegheny River below Sharpsburg, Dr. A. Ziegler, August 26, 1889.

Physalis heterophylla Nees.

Allegheny Cemetery, Pittsburgh, J. A. Shafer, August 31, 1884.

Physalis pubescens Linnæus.

Pittsburgh, Rev. S. W. Knipe, September, 1869.

Galium aparine Linnæus.

Powers Run, O. E. Jennings, May 25, 1904.

Galium concinnum Torrey & Gray.

Low woods near Stoops Ferry, J. A. Shafer, June, 1889.

Galium triflorum Michaux.

Roadside near Sheridan, Dr. Adolph Koenig, August 10, 1897.

Nabalis trifoliatus Cassini.

Not uncommon.

Taraxacum erythrospermum Andrzejewski.

Common everywhere.

Species from Allegheny County in the Pennsylvania Herbarium of the Carnegie Museum and so reported in the "Preliminary List," but which are found to have been identified incorrectly:

Physalis virginiana intermedia Rydberg.

Edgewood, C. C. Mellor. Not *P. philadelphica* Lamarck as reported in the "Preliminary List."

Ilysanthes attenuata (Muhlenberg) Small.

The several Allegheny County specimens in the Pennsylvania Herbarium are evidently of this species and not *Ilysanthes dubia* (Linnæus) Barnhart (*I. gratioloides* Benthams) as reported.

Lactuca virosa Linnæus.

This is the common "Compass Plant" of vacant lots, cultivated fields, etc., and not *Lactuca scariola* Linnæus, as reported and as generally mistaken by American botanists a few years ago.

CARNEGIE MUSEUM,

November 24, 1905.

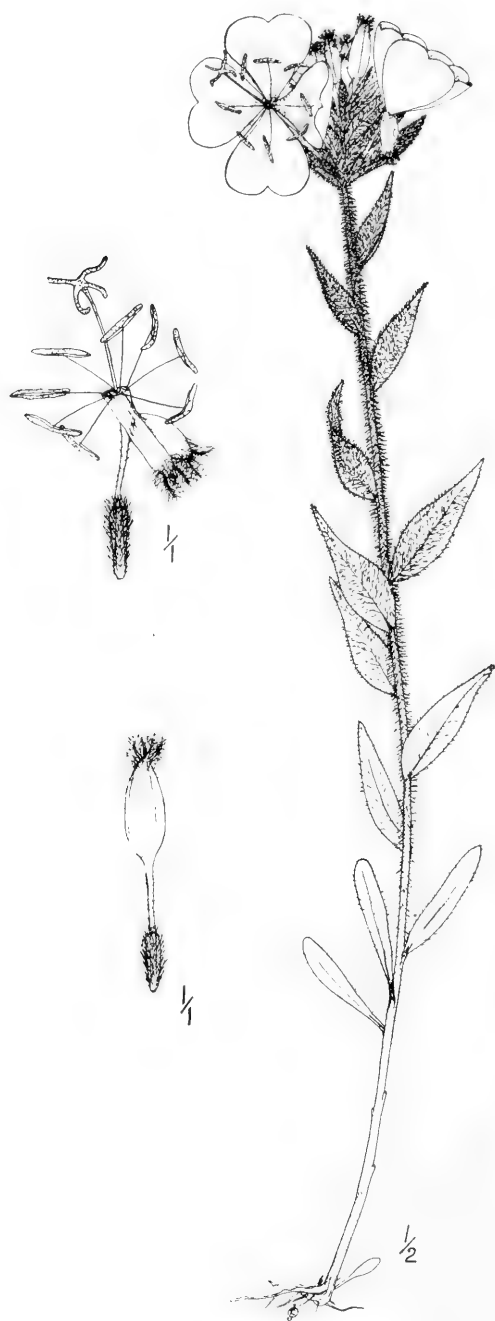
XV. A NEW SPECIES OF KNEIFFIA.

BY OTTO E. JENNINGS.

Kneiffia sumstinei n. sp. Sumstine's Sundrops.

Stems simple, somewhat shrubby, about 3.5 dm. high, ascending from the base, or nearly erect, densely hairy above, with very widely spreading, or mainly reflexed, stiff, silvery hairs, 2-3 mm. in length. Leaves entire, 3-6 cm. long, .5-1.2 cm. wide, stiff and ascending, the lower slightly hairy, linear-obovate, rounded at the apex, at the base narrowed into a margined petiole from the attachment of which striations run down the stem. Upper leaves becoming lanceolate or ovate-acuminate, sessile, very densely hairy on both sides, with widely spreading, or reflexed, silvery hairs 1-1.5 mm. long. Flowers 8-12, diurnal, bright yellow, erect in the bud, in the axils of bracts as large as the upper leaves and similar to them, aggregated into a rather dense corymbose inflorescence; calyx-tube linear-funnel-form, prolonged 1-1.4 cm. beyond the ovary, sparsely pubescent, calyx segments reflexed in flower, lanceolate, about as long as the tube, tips linear, 2-3 mm. long, erect, or ascending from widely diverging bases, the tips and the upper fourth of the calyx-segments tomentose-pubescent; petals obcordate, 2.2-2.5 cm. long, 2 cm. wide; stamens of equal length, or very nearly so, about two thirds the length of the petals; style slightly longer than the stamens, the lobes of the stigma linear, widely spreading, 4-6 mm. long. Mature capsule not seen; ovary sessile, oblong to slightly obovate, faintly winged, densely pubescent with ascending hairs. Dry upland field near Kittanning, D. R. Sumstine, June, 1905. Type specimens in the Pennsylvania Herbarium of the Carnegie Museum. Acc. No. 2905.

This species is evidently nearly related to *Kneiffia fruticosa* (Linnaeus) Raimann, perhaps more closely to *Kneiffia fruticosa pilosella* (Rafinesque-Schmaltz) Britton, but in general appearance it is quite different, the strictly simple habit, the large leafy bracts, and the more densely aggregated inflorescence serving to differentiate it at once. Further differences are apparent in the mostly reflexed, silvery



Kneiffia sumstinei Jennings.

pubescence, and the widely diverging, tomentose-pubescent calyx tips. In the dried specimens at least, there is no discernible inequality in the length of the stamens, the species thus apparently overstepping what is usually regarded as a generic character. Prof. D. R. Sumstine, by whom the specimens were collected, reported the species as growing very abundantly in a field on a hill-top near Kittanning and in September last the writer, hoping to secure mature capsules, made a diligent but unsuccessful search in the locality indicated, but it was found that the field had been mowed and all weeds destroyed. It is hoped that in another year mature fruit may be collected and studied.

In Plate XIX. are shown a figure of the plant one half natural size, and figures of the unopened bud and of the flower with the petals removed, each natural size.

CARNEGIE MUSEUM,

November 20, 1905.

XVI. A NOTE ON THE OCCURRENCE OF TRIGLOCHIN
PALUSTRIS LINNÆUS IN PENNSYLVANIA.

BY OTTO E. JENNINGS.

Of the three species of *Triglochin* occurring in the eastern part of the United States but one, *Triglochin maritima* Linnæus, is reported in the late Dr. T. C. Porter's "Flora of Pennsylvania,"¹ but the evidence at hand seems to indicate a confusion in the report of this species with *Triglochin palustris* Linnæus.

Triglochin maritima Linnæus is found in Europe and Asia, and in America "In salt marshes, along the Atlantic sea-board from Labrador to New Jersey, and in fresh or saline marshes across the continent to Alaska and California,"² and so might be expected to occur in Pennsylvania, but in the Pennsylvania Herbarium of the Carnegie Museum there is a sheet from the herbarium of Lafayette College and bearing Dr. Porter's label, "*Triglochin palustre* L., Presque Isle, Erie, Pa., July 24, 1868, Leg. A. P. Garber." The specimens on this sheet are typically *Triglochin palustris* Linnæus, as are also specimens in the Pennsylvania Herbarium of the Carnegie Museum collected at Presque Isle by Gustave Guttenberg, August 5, 1880.

On August 26, 1905, the writer collected several hundreds of fine fruiting specimens of *Triglochin palustris* Linnæus along the sandy shores of ponds at the eastern end of Presque Isle but a careful search failed to discover any other species of *Triglochin* and taking this fact in connection with the identity of the Lafayette College specimens there seems to be good grounds for assuming that Pennsylvania has thus far produced only one species of *Triglochin*, viz.: *Triglochin palustris* Linnæus.

CARNEGIE MUSEUM,

November 21, 1905.

¹ Porter, T. C., "Flora of Pennsylvania," edited by J. K. Small, 1903.

² Britton, N. L., "Manual of the Flora of the United States and Canada," 2d. edit., p. 53, 1905.

XVII. A NEW SPECIES OF IBIDIUM (GYROSTACHYS).

BY OTTO E. JENNINGS.

Ibidium incurvum sp. nov.

Radicibus pluribus fere 2-8, carnosis fasciculatis: caule 1.5-6 dm. alto, superne dense et minutissime glanduloso-pubescente: foliis caulinis mediis et superioribus 2-6, bracteiformibus, basi vaginantibus, apice anguste acutis vel elongato-acuminatis; foliis radicalibus et foliis caulinis inferioribus 2-7, acutis vel raro obtusiusculis, 3-20 cm. longis, .4-1.8 cm. latis; foliis radicalibus lineari-oblongis vel ovatis, parte basali abrupte angustata in petiolum marginatum; foliis caulinis inferioribus linearis vel lineari-oblongeolatis, inferne sensim angustatis in basin vaginantem, foliis caulinis superioribus vaginantibus bracteiformibus: spicis 8-15 cm. longis, 1.6-2.5 cm. latis, obtusis, densis, multifloris; bracteis ovatis, cum $\frac{2}{3}$ parte florum æquilongis, apice elongato-acuminato: floribus sessilibus, albis vel raro subluteis, 1.4-1.9 cm. longis, recurvato-patentibus; ovario et sepalis ad basin minutissime glanduloso-pubescentibus; sepalis triangulari-lanceolatis, acutis vel obtusiusculis, 1.1-1.6 cm. longis, 2-3 mm. latis; petalis lateralibus cum sepalis æquilongis, oblongo-lanceolatis, apice late obtusis vel suborbiculatis, plus minusve crenulatis, ad basin nervis lateralibus bifurcatis; labello 1.2-1.7 cm. longo, 4-7 mm. lato, plus minusve unguiculato, medio plus minusve contracto, apice obtuso aut etiam orbiculato plus minusve laciniato, basi truncato-vel cordato-orbiculato, nervis bifurcatis; callis gracilibus incurvis, basi dense pubescentibus et plus minusve glanduloso-pubescentibus: capsulis obovato-oblongis, sæpe curvis, 1-1.4 cm. longis.

Roots several, mostly 2-8, fleshy, fascicled: stem 1.5-6 dm. high, above densely and minutely glandular-pubescent: middle and upper cauline leaves 2-6, bract-like, sheathing at the base, at the apex narrowly acute to long acuminate; basal leaves and lower cauline leaves 2-7, acute, or rarely somewhat obtuse, 3-20 cm. long, .4-1.8 cm. wide; basal leaves linear-oblong to ovate, the lower part abruptly narrowed to a margined petiole; the lower cauline leaves linear to linear-oblongeolate, gradually narrowed below to a sheathing base, the

upper cauline leaves sheathing, bract-like : spikes 8-15 cm. long, 1.6-2.5 cm. thick, obtuse, dense, many flowered ; bracts ovate, two thirds as long as the flowers, apex elongate-acuminate : flowers sessile, white or rarely somewhat yellowish, 1.4-1.9 cm. long, recurved-spreading ; ovary and sepals minutely glandular-pubescent toward the base ; sepals triangular-lanceolate, acute or somewhat obtuse, 1.1-1.6 cm. long, 2-3 mm. wide ; lateral petals same length as sepals, oblong-lanceolate, at the apex widely obtuse or sub-orbicular, more or less crenulate, the lateral nerves forked toward the base ; lip 1.2-1.7 cm. long, 4-7 mm. wide, somewhat clawed, more or less contracted at the middle, at the apex obtuse or even orbicular, more or less laciniate, at the base truncate- or cordate-orbicular, nerves forked ; callosities slender, incurved, at the base densely pubescent and more or less glandular pubescent : capsules obovate-oblong, often curved, 1-1.4 cm. long.

The type specimens, now in the Pennsylvania Herbarium of the Carnegie Museum, were collected by the writer on Presque Isle, Erie, Pa., Aug. 24-26, 1905. The plants were quite abundant in the damp sand surrounding the ponds in the more recently formed land at the eastern end of the peninsula. In the herbarium of the Carnegie Museum are other specimens of this species, collected also on Presque Isle, August 16, 1880, by Gustave Guttenberg, and a large bundle of typical material collected September 9-11, 1900, by J. A. Shafer.

The specific name *incurvum* is given this species from the quite strongly and sharply incurved callosities, a constant character, which will at once serve to distinguish this species from *Ibidium cernuum* (Linnæus) House. Perhaps the most closely related species is the more southern *Ibidium odoratum* (Nuttall), which ranges from Virginia and Kentucky southward through the Gulf States, but the differences are, nevertheless, quite marked between the two species.

In order to more clearly contrast the diagnostic characters of *Ibidium incurvum* with the other species of the genus occurring in the northeastern part of the United States, the following key has been worked out, mainly in accordance with the plan followed in Britton's "Manual."¹ Recent studies in this genus by Ames, "Contributions Toward a Monograph of the American Species of *Spiranthes*",² and

¹ Britton, N. L., "Manual of the Flora of the Northern States and Canada," 2d edit., 1905.

² Ames Oakes, "Orchidaceæ : Illustrations and Studies of the Family Orchidaceæ," Fascicle I., 1905.

by House, "Further Notes on the Orchids of Central New York",³ have quite materially changed our conception of several of the species and their synonymy. The writer would adopt, for reasons of prior definite publication as stated by House,³ the genus *Ibidium* of Salisbury (1812) rather than the questionable *Gyrostachis* (1807) of Persoon or the *Spiranthes* (1818) of L. C. Richard, and the species here referred to are accordingly placed under that heading.

KEY TO THE SPECIES OF IBIDIUM OCCURRING IN THE NORTHEASTERN UNITED STATES.

Flowers 3-ranked; stems not twisted, or but slightly so.

Sepals and petals more or less connivent into a hood.

I. strictum (Rydberg) House.⁴

Lateral sepals separate, free.

Spike 2-8 cm. long; callosities minute or none.

Lip less than 5.5 mm. long, constricted at or above the middle.

I. parviflorum (Chapman).

Lip more than 5.5 mm. long, not conspicuously constricted.

I. plantagineum (Rafinesque) House.

Spike 8-15 cm. long; callosities conspicuous.

Spike 12-14 mm. thick; callosities straight.

Flowers yellowish; spike acute; lower bracts longer than flowers.

I. ochroleucum (Rydberg) House.⁵

Flowers white; spike obtuse; lower bracts shorter than flowers.

I. cernuum (Linnæus) House.

Spike 16-25 mm. thick; callosities incurved.

Flowers white; callosities pubescent; lateral petals obtuse.

I. incurvum.

Flowers yellowish; callosities glabrous; lateral petals acute.

I. odoratum (Nuttall).

Flowers alternate; spike secund by twisting of the stem.

Stem leafy, lower bracts elongated, persistent.

Outer sepals lanceolate; lip oblong, outer end broadest, smooth beneath.

I. præcox (Walter).

Outer sepals linear; lip ovate to ovate-oblong, broadest below, pubescent beneath.

I. vernalis (Engelmann & Gray) House.⁶

Stem a scaly scape; leaves basal, fugacious.

Root usually a single tuber; spike about 2.5 cm. long.

I. Beckii (Lindley).⁷

³ House, H. D., "Further Notes on the Orchids of Central New York," *Bull. Torr. Bot. Club*, 32: 373-382, 1905.

⁴ Ames, I. C., includes this with *Spiranthes Romanzoffiana* Chamisso.

⁵ Ames, I. C., regards this as "An upland form" of *Spiranthes cernua* Richard.

⁶ (*Gyrostachys linearis* Rydberg) as in Britton's Manual, 300, 1905.

⁷ (*Gyrostachys Grayi* (Ames) Britton) as in Britton's Manual, 300, 1905.

Roots fasciculate; spike 2-7 cm. long.

I. gracilis (Bigelow) House.

CARNEGIE MUSEUM,

January 15, 1906.

EXPLANATION OF PLATE XX.

A. Ibidium incurvum. Whole plant. One half natural size.

B. Floral bract. Twice natural size.

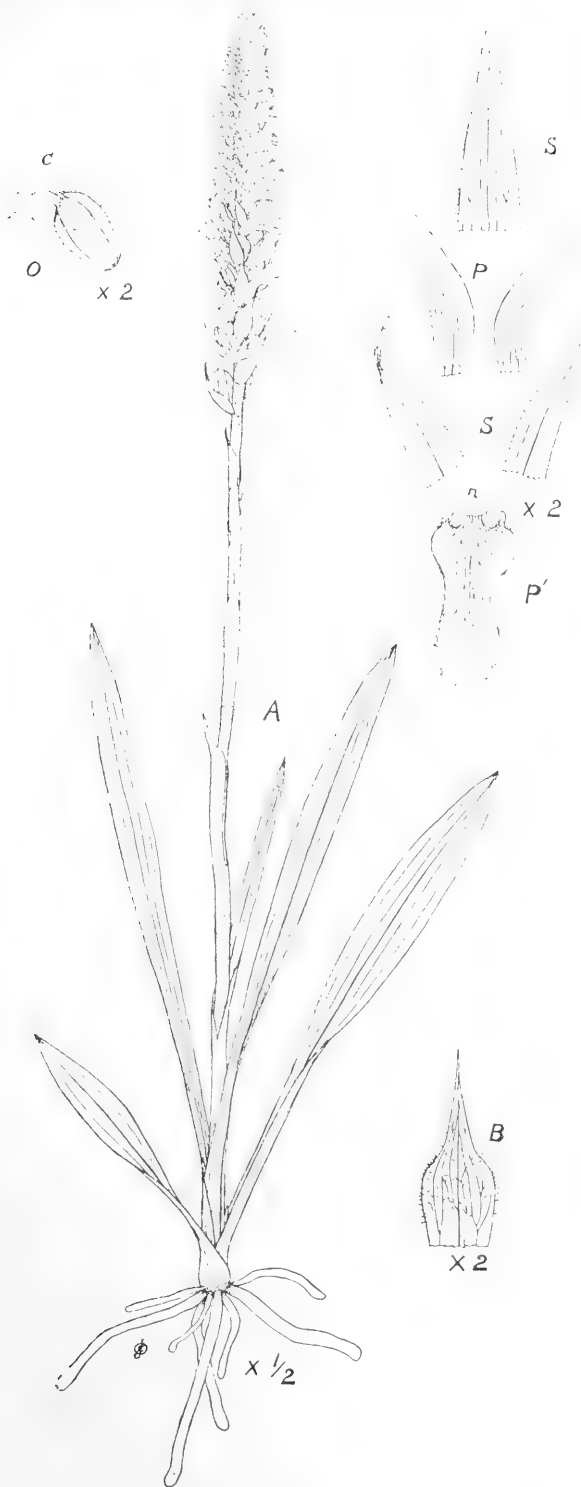
O. Ovary. Twice natural size.

C. Column. Twice natural size.

S. Sepals. Twice natural size.

P. Lateral petals. Twice natural size.

P'. n. Lip, *n.* Callosities. Twice natural size.



Ibidium incurvum Jennings.

XVIII. THE AGATE SPRING FOSSIL QUARRY.¹

BY O. A. PETERSON.

In 1904 a field party of the Carnegie Museum, the writer in charge, was extremely fortunate in discovering what will undoubtedly prove to be one of the most important quarries of fossils as yet discovered in the Miocene of North America. Geographically the quarry is located on the Upper Niobrara River, locally known as the "Running Water," in Sioux County, Nebraska. It is about twenty-five miles southeast of Harrison, a station on the Fremont, Elkhorn, and Missouri Valley Railroad.

The geological horizon in which the quarry is located is at the base of the Nebraska² Beds, or the top of the Harrison Beds.

In 1890 Mr. James H. Cook, on whose property the Agate Spring Fossil Quarry is located, discovered many small bones and fragments in the talus from the fossil-bearing stratum of the hills, in which the quarry is located. Very naturally he thought that the bones were those of Indians interred together with their horses. Mr. Cook accompanied me to this place in August, 1904. Realizing that this was a discovery of much paleontological promise we immediately began work on the deposits and resumed work early in the season of 1905.

The quarry is about one quarter of a mile south of the river referred to above. It is near the base of two closely connected and rounded buttes, which have been separated by erosion and in part covered by vegetation. These hills are composed of a buff-colored sandstone varying in degrees of hardness. A layer of about three or four feet in thickness, including that of the fossil-bearing stratum, is of a rather light color. The strata in this immediate vicinity, including that of this fossil quarry, have a slight dip northward. Immediately under and overlying the fossil-bearing stratum there are layers of compact

¹ Read before the American Society of Vertebrate Paleontologists, December 27, 1905.

² Scott, *Bull. Geol. Soc. Am.*, Vol. V., pp. 595-596, 1893. Hatcher, *Proc. Am. Philos. Soc.*, Vol. LXI., pp. 117-118, 1902. Peterson, ANN. CARNEGIE MUSEUM, Vol. II., pp. 473-474, 1904. Darton, U. S. Geol. Survey, "Geology and Underground Water Resources," pp. 177-178, 1905.

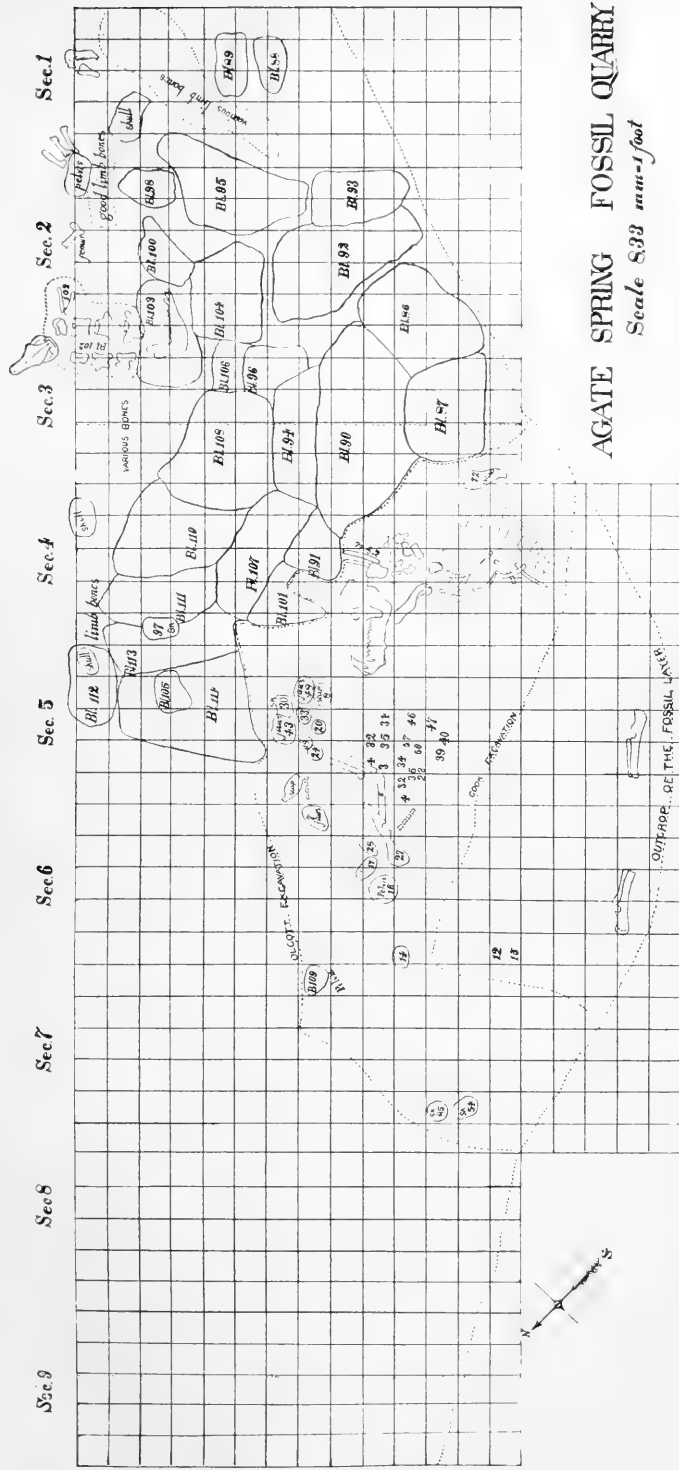
and quite hard sandstone. The fossils are embedded in softer matrix in a stratum of approximately twenty inches vertical thickness. The bones are sometimes found to be slightly crushed, but on the whole the material is in a very fine state of preservation.

During the season of 1905 the party uncovered an area of 45 x 20 feet in the quarry. This area was plotted out in squares five feet in dimension, and a diagram (see Plate XXI.) was made representing this arrangement. The bones are found mostly disarticulated, much mixed, and thickly distributed through this layer of sandstone. It was soon discovered that the most intelligent way in which to secure this tangled



FIG. 1. View of the two rounded hills where the Agate Spring Fossil Quarry is located.

mass of material was to take out blocks of sandstone which contain the fossils. On the diagram the more important specimens are always indicated, as are the areas in the quarry where the bones are less abundant, and the numbers correspond to every package. Thus an intelligent idea of the various features of the quarry may be had at any time. The sketch is of importance in connection with the work in the laboratory. By this system of carefully indicating the relative size, shape, and position of each block, the correct association of the parts of any articulated skeleton, which may be found in this great mixture of bones, will be possible.



Plan of Agate Spring Fossil Quarry.

The irregular line on the diagram of the Agate Spring Fossil Quarry (see Plate XXI.), marked "Outcrop of the Fossil Layer" indicates the contour of the hill before work was commenced. The region marked "Cook Excavation" represents the area, which Mr. Cook excavated in the fall of 1904. Mr. Cook, realizing the importance of having the specimens preserved by the best and most modern styles of collecting, kindly desisted from his operations, after receiving a letter from the writer with an earnest appeal for postponement of effort until the party from the Carnegie Museum should reach the spot in the following spring (1905). From the line of Mr. Cook's explor-



FIG. 2. Excavating in the Agate Spring Fossil Quarry.

ation the excavations and work were carried on by Mr. T. F. Olcott from April until July, when the writer accompanied by Dr. J. A. Hermann again joined the party, and continued work with it during the remainder of the season of 1905. Toward the latter part of the season Mr. W. H. Utterback also joined us and together we accomplished quite effective work. The blank area on the sketch indicates the exposed layer where work will be resumed in the coming season of 1906.

The outlines of the blocks are nearly always irregular. This is due to the method which we were sometimes forced to follow in working around an important specimen in order not to break through its

center. When a block has been outlined, and it is decided where it is to be detached, it is bandaged and undermined to that point, and easily broken off from the main ledge in the quarry. The broken surface of the block and the corresponding face of the quarry are now carefully shellacked to prevent the contacts from crumbling. The different faces of the blocks are lettered and numbered to facilitate work in the laboratory. Plaster of Paris and strips of burlap, together



FIG. 3. Face of the Agate Spring Fossil Quarry. Each numbered section is five feet long.

with flour-paste and delicate strips of muslin, where they are needed in protecting the bones and to firmly hold the block together, are the materials employed in connection with quarries of this kind.

A PROVISIONAL LIST OF THE FAUNA.

Of the more important forms found in the quarry the following may be mentioned.

Diceratherium Marsh, the remains of which are apparently most abundant. Other genera of rhinoceroses, besides *Diceratherium*, are also present. Some fifty or sixty skulls, lower jaws, and other skeletal material of rhinoceroses have already been taken out of the

quarry. Next in importance is the very large *Elotherium* which I have provisionally named *Dinohyus hollandi*, pending a more systematic study of the specimen. *Moropus distans* Marsh is well represented by limbs, foot-bones, parts of jaws, teeth, etc. *Merychys* Leidy and other small forms are also present. Among this general mixture are found the remains of some carnivores, common in these horizons.

From this list it would appear at first sight, that the geological horizon in which this quarry is located, should be referred to the same horizon as the Upper John Day of Oregon. The fact, however, remains that the entire fauna, which is at present known from the upper series of the Miocene section in western Nebraska and eastern Wyoming, shows more highly specialized characters than obtained in the fauna known from the Upper John Day. For example, no such specialized forms among the Oreodontidæ as *Merychys elegans*, *Merycocharus proprius* Leidy, and the artiodactyls *Merycodus* Leidy, and *Syndyoceras Cooki*, recently described by Barbour, have been reported from the Upper John Day.

Moropus distans is much larger and doubtless differs otherwise from the form represented in the John Day formations. When the material representing *Diceratherium* from the Agate Spring Quarry is prepared for study, there will, no doubt, be found a number of important specific, if not generic differences, separating it from the material representing the genus in the John Day Beds.

From these recent discoveries it appears that the Miocene section from the Oligocene to the top of the Nebraska Beds, in this general locality may perhaps have to be regarded as belonging to the lower Miocene. From the study of the subdivisions of the Miocene strata in western Nebraska, and eastern Wyoming as distinguished by Hatcher,¹ we understand that the Harrison Beds represent the hiatus between the Upper and Lower Deep River Formations in Montana. Since *Diceratherium* and the large *Dinohyus* have been discovered in the uppermost Harrison or at the base of the Nebraska Beds it would seem to indicate the necessity of regarding the Monroe Creek Beds as of considerably later geologic age than that assigned to them by Hatcher. The Gering Beds which form the lowermost division in the Miocene formation in this locality, would then have to be regarded as equivalent to the Upper John Day and Lower Deep River. However, a

¹ *Loc. cit.*, p. 118.

final determination regarding any proposed change from the geological order of these strata known at present should be postponed until the extensive paleontological material from this region, especially from the Agate Spring Quarry, is studied.

At this point I wish to record my idea regarding the origin of the sediment in this fossil quarry and its immediate neighborhood, to-



FIG. 4. Cliff one mile north of Agate Spring Fossil Quarry. The light-colored stratum is laminated.

gether with the probable way in which the bones may have been deposited. I have said that the stratum in which the fossils are found in the quarry is of a light color. In fact this layer is easily distinguished by its color from the under- and over-lying strata in this locality. The stratum varies in thickness from a few feet to approximately twenty feet, which is the maximum vertical depth. I have examined



FIG. 5. Exposed point in Niobrara Valley one mile northwest of Agate Spring Fossil Quarry. The light-colored stratum is approximately twenty feet thick.

this particular layer in different places, sometimes at one or two miles distant from the quarry, and have nearly always found abundant evidence of laminated structure. It would appear from the evidence at hand that this light-colored stratum is of lacustrine origin. The color precludes the idea that there was heavy vegetation, which, according

to the views of the writer, would have imparted a darker hue to the stratum. This supposed lake probably had a small geographical area, and judging from the comparatively thin, light-colored stratum, a relatively short duration in geological time.

I referred to a hard sandstone stratum forming the floor of the quarry. In this stratum are often found foot-bones and sometimes fragments of limb-bones, which are almost unrecognizable on account of their much worn condition. It is evident that the bones were subject to moving water. Bones of greater weight and those which have broad surfaces are always quite perfect in this stratum, retaining all their sharp angularities. It would seem that there are at least two plausible explanations of these facts.

(1) That there might have been a stream of water which gradually carried the foot bones of *Moropus* and other animals down stream, thus causing their worn condition. (2) That the supposed lake, referred to above, might have had coves along its borders, especially at the mouth of streams. There might have been a large spring of water at one of these particular recesses near the shore of the lake, which was much resorted to by various animals during certain seasons of the year. When the water of the lake rose as the result of swollen streams and continuous rains, it might have reached this veritable bone-yard. The bones, which were small and had angles offering less resistance to the waves, might then have been washed back and forth by the action of the water, while flat and heavier bones remained stationary. This latter view is, I think, the more plausible, according to the evidence at hand in the Agate Spring Fossil Quarry and its immediate neighborhood.

XIX. DESCRIPTION OF TWO NEW BIRDS FROM BRITISH EAST AFRICA.

BY HARRY C. OBERHOLSER.

Among the birds from Mombasa, British East Africa, collected by Mr. William Doherty, and recently acquired by the Carnegie Museum,¹ are specimens of two forms which appear to be unnamed. Through the courtesy of Dr. W. J. Holland the following descriptions of these are here presented.

***Astur tachiro orienticola*, subsp. nov.**

Subspecific characters. — Similar to *Astur tachiro tachiro*, but rather smaller; upper parts lighter, the head and cervix conspicuously paler than the remaining upper parts, the sides of head and neck much lighter still; posterior lower surface paler, with much less of rufous, particularly on flanks and flags.

Description. — Type, adult male, No. 7763, Carnegie Museum; Mombasa, British East Africa, September or October, 1900; William Doherty. Pileum and cervix slate-gray, the remaining upper surface slate color, posteriorly with a slight brownish tinge; tail sepia-brown, the outer feathers lighter and rather more rufescent, all the rectrices tipped with buffy white and crossed by four broad blackish bands, and most of them, including the middle pair, with two or three white or whitish spots in the light interspaces of the inner webs; wing-quills fuscous, the basal portions of inner webs white, the inner webs of all but tertials and innermost secondaries barred with blackish or dark brown; sides of head and neck grayish plumbeous; under surface white, posteriorly washed with buff, the chin and upper throat vermiculated with pale grayish, the crissum sparingly and narrowly barred with the same; the rest of the ventral surface including flags conspicuously, regularly, and rather closely, though narrowly, barred with wood-brown, this becoming more rufescent on the sides of the body, where also the bars are wider, and paler and on the lower abdomen where they are narrower and farther apart; lining of wing creamy

¹ Cf. Holland, ANNALS CARNEGIE MUSEUM, III., 1905, pp. 453-463.

white, with scattered and irregular barrings of dull brown. Length of wing, 198; tail, 172; exposed culmen with cere, 22; culmen without cere, 16.5; tarsus, 59; middle toe, 33; middle claw, 12.5; hind claw, 18 mm.

The considerable differences which separate this race from true *Astur tachiro* have already been indicated by Dr. Reichenow.² Its range includes probably at least the eastern, or coastal, portion of both British and German East Africa. The original *Astur tachiro*³ came from southern Africa, as did also the *Nisus polyzonus* of Lesson,⁴ so that the present form seems hitherto to have received no name.

Cisticola heterophrys, sp. nov.

Specific characters.—Similar to *Cisticola chiniana*, but lacking any well-defined superciliary stripe; upper surface duller and much more uniform, the pileum darker and without trace of dusky streaks, the feathers of back and wings without conspicuously light edges, lower surface not so purely white, and laterally more shaded with grayish.

Description.—Type, adult male, No. 8125, Carnegie Museum; Mombasa, British East Africa, September or October, 1900; William Doherty. Pileum uniform rufescent mummy-brown; remainder of upper surface hair-brown, somewhat rufescent on the cervix, the feathers mostly with darker centers which on back and scapulars produce a streaked effect; tail bistre-brown, indistinctly and narrowly barred with dusky; the middle pair of rectrices with a wider subterminal bar of dark brown, the remaining feathers with a broad terminal bar of buff and a subterminal one of black; wings fuscous, the greater, lesser, and median coverts, together with the tertials, edged rather broadly with hair-brown, the greater coverts more rufescent, the primary coverts, primaries, and secondaries margined with chestnut and rufous chestnut; lores and orbital ring dull buff; sides of head dull light brown mixed with buff; sides of neck hair-brown; ventral surface dull white, slightly washed with buffy, the sides of breast and body shaded with gray; thighs rufous; lining of wing buffy white; bill black, the base of mandible whitish.

² Vögel Afrikas, I, 1901, p. 552.

³ *Falco tachiro* Daudin, Traité d'Ornith., II, 1800, p. 90 ("pays d'Auteniquoi").

⁴ *Nisus polyzonus* Lesson, Traité d'Ornith., 1831, p. 58 (Cape of Good Hope).

The two specimens of this species, both adult males, in the collection of the Carnegie Museum have been identified as *Cisticola chiniana* by Dr. Reichenow, but they clearly are not *Cisticola chiniana* (Smith),⁵ with specimens and the original description of which they have carefully been compared. From *Cisticola subruficapilla*, which, by the way, seems to be a perfectly distinct species, occurring in many localities along with *C. chiniana*, our bird differs much as from *C. chiniana*, and additionally in its decidedly larger size. It is, moreover, in general appearance much more nearly like *Cisticola prinioides*, from which, however, it may easily be distinguished by its paler lower surface, and particularly by its pale lores and eye-ring. It is thus in fact intermediate between the group typified by *Cisticola chiniana* and that composed of *Cisticola prinioides*, *C. neumanni*, and *C. hunteri*.

Measurements of *Cisticola heterophrys* are given herewith:

| Sex. | Locality. | Date. | Wing. | Tail. | Exposed Culmen. | Tarsus. |
|-------|--|----------------------|-------|-------|-----------------|---------|
| Male. | Mombasa, British East Africa. ⁶ | Sept. or Oct., 1900. | 65 | 57 | 11.5 | 23 5 |
| Male. | Mombasa, British East Africa. | Sept. or Oct., 1900. | 62 | 54 | 13 | 25 |

⁵ *Drymoica chiniana* Smith, Ill. Zool. S. Afr., 1843, pl. LXXIX. (North of Kurrichaine, Bechuana Land, South Africa.)

⁶ Type.

XX. THE CHAZY FORMATION AND ITS FAUNA.¹

BY PERCY E. RAYMOND.

INTRODUCTION.

As long ago as 1847 Professor James Hall stated: "I think there is scarcely another portion of our series that offers a better field for a paleontologist than the lower limestones, which are so well developed along the valley of Lake Champlain, the Mohawk Valley, and the Black River" ("Paleontology of New York," Volume 1).

Despite this promising suggestion, for sixty years the field has lain almost neglected, as practically nothing has been added during that time to our knowledge of the Chazy faunas in New York.

From the Canadian outcrops of these same beds Billings in 1858 to 1865 described many new species, but very few, if any, of these have even been noted in the New York and Vermont areas.

During their stratigraphic work in the Champlain Valley Brainerd and Seely collected many fossils from the Beekmantown and Chazy strata, and Whitfield described many new species from their collections. Practically all of these were, however, from the Beekmantown, so that there have been only two or three species added to the Chazy fauna since the publication of Billings' last paper on the subject in 1865. Recently (April, 1905), an article by Professor Hudson of Plattsburgh has appeared, in which several interesting new species are described.

Upon taking up the work the original intention of the writer was to study the faunas of the Chazy formation in regard to their association, range, and distribution, but after a little study of the collections made for that purpose it was found that there were many unknown species, and that there was much uncertainty about many of the described species, so that identification of the material was impossible.

¹ This article is one of a series on the Chazy formation and its fauna. The first, entitled "The Trilobites of the Chazy Limestone," appeared in the ANNALS of this Museum in March, 1905. The other articles will appear in successive numbers of the ANNALS. An abstract of this article appeared in the *American Journal of Science and Arts* in November, 1905.

Accordingly it was necessary first to undertake a revision of the Chazy fossils and this work constitutes the bulkier part of the present series of articles.

The collections on which this study is based have been made during the last five field seasons, first for the writer's private collections and later for the Cornell, Yale, and Carnegie Museums. Field work has been carried on in the Lake Champlain region, the Ottawa Valley, the Mohawk Valley, Central Kentucky, Eastern Tennessee, and Minnesota, and for opportunity to do this work I have been especially indebted to Professor Gilbert D. Harris, of Cornell, and to the late Professor C. E. Beecher, of Yale. For other favors in connection with this work I am indebted to several gentlemen and to them I have expressed my obligations in the body of the paper. My thanks are due Professor Charles Schuchert, who has read the manuscript and made many valuable suggestions. To Professor George H. Hudson, of Plattsburgh Normal School, I am indebted for valuable assistance in the field and for some of the photographs which illustrate this article.

DISTRIBUTION OF THE CHAZY FORMATION.

The Chazy formation was named by Ebenezer Emmons (Final Report, Geology, New York, 1842) from the outcrops studied by him at Chazy Village, New York, and so that locality becomes typical for the formation.

In stratigraphic position the Chazy overlies the Beekmantown (formerly known as Calciferous), and underlies the Lowville (formerly known as Birdseye), a member of the Mohawkian. The Chazy formation may be traced from Chazy north and south along the Champlain Valley from Orwell, Vermont, to Joliette, north of Montreal, and northwest along the Ottawa Valley to Allumette Island, eighty miles northwest of Ottawa. The formation has been detected again at the Mingan Islands in the Gulf of St. Lawrence, where it covers a small area.

In the region of Lake Champlain the strata of the formation are mostly limestone and the thickness ranges from 60 feet at Orwell to 890 feet at Valcour Island. Further north the thickness is not definitely known. In the region of the Ottawa Valley the formation is usually 100 to 200 feet in thickness and is about half limestone and half sandstone, the limestone usually overlying the sandstone. At the Mingan Islands the thickness of the formation is estimated at 300 feet and the strata

include both limestone and shales. In describing the formation, these three areas will be discussed separately.

THE LAKE CHAMPLAIN REGION.

As stated in the introduction, the work undertaken by the writer has been purely paleontologic in character, and for the stratigraphy I have followed the Chazy sections as described by Brainerd and Seely. In the course of the work the sections at Chazy, Valcour Island, and Crown Point have been remeasured and the results are within a few feet of those reached earlier by Professors Brainerd and Seely. In this place it seems better to give their synoptical tables than to present the rather detailed sections prepared by the writer. For a description of the formation north of the Canadian boundary to Montreal, the reports of Logan, Ells, and Ami are drawn upon (Geology of Canada, 1863, and Reports of the Canadian Geological Survey, 1896 and 1899).

In general the Chazy rocks are exposed along the western side of Lake Champlain in a narrow belt running almost north and south from Joliette, north of Montreal, to Orwell, Vermont. The belt in which these rocks occur is seldom more than ten miles wide, and is not a continuous exposure, but the formation occurs in small patches, in most cases evidently fault blocks, and the strata are usually inclined at a considerable angle. The most frequent dip is northeast, but there are many places where the dip is northwest or west. There are some places where the rocks are perfectly horizontal, but these regions are of small extent.

The principal outcrops are along the west side of Lake Champlain and on the islands in the northern part of the lake. South of Willsboro Point there are scattered patches on both sides of the lake nearly to Fort Ticonderoga, the most southern exposure on the west side being about ten miles north of that place. On the eastern side the most southern outcrop of all is at Orwell, five or six miles east of the lake. The description of the section at Chazy will be given first, and then other prominent localities in their order, going southward.

The Chazy Section.

In the type section at Chazy the base of the formations is not shown. Brainerd and Seely divided the formation into three divisions, A, B, and C, which are in order the Lower, Middle, and Upper Chazy.

Section at Chazy, New York. After Brainerd and Seely.

Group A: Lower Chazy, 310 feet.

1. Iron gray, fine-grained, dolomitic limestone in beds one to two feet in thickness, weathering to drab, with fine yellowish streaks at right angles to the plane of bedding. Containing *Orthis costalis*² and crinoidal fragments.

110 feet. 110 feet.

2. Tolerably fine limestone filled with fragments of crinoids, containing *Orthis*³ and *Rafinesquina*.

20 feet. 130 feet.

3. Measures concealed.

40 feet. 170 feet.

4. Measures of impure limestone filled with *Orthis*⁴ at bottom, thin-bedded when long exposed to the weather, the upper six feet abounding in crinoidal fragments.

30 feet. 200 feet.

5. Fine-grained massive limestone containing *Scalites angulatus*, *Raphistoma*, and fragments of trilobites.

25 feet. 225 feet.

6. Impure limestone abounding in *Orthis*.⁴

10 feet. 235 feet.

7. Measures concealed.

25 feet. 260 feet.

8. Massive gray limestone, largely made up of crinoidal remains, having red spots in the stratum about ten feet from the top; abounding in gastropods⁵ near the middle.

50 feet. 310 feet.

Group B: Middle Chazy, 265 feet.

1. Thick-bedded, nodular, dark-colored limestone, containing *Maclurites magnus*.

50 feet. 50 feet.

²Probably *Hebertella exfoliata*, but possibly *Hebertella vulgaris*. In the following sections and lists taken from the works of Messrs. Brainerd and Seely, Logan, Ells, Billings, and Ami, I have brought the generic names down to date and have also noted the fact, when the identifications seem in the light of recent work to be faulty.

³Probably *Hebertella*.

⁴*Hebertella*.

⁵*Raphistoma stamineum* and *Lophospira subabbreviata*.

2. Massive, pure limestone, gray, fine-grained, often oölitic, abounding in crinoidal remains and *Stenopora fibrosa*.⁶

20 feet.

70 feet.

3. Massive, bluish-black, tolerably pure nodular limestone, containing *Maclurites magnus* and masses of black chert.

45 feet.

115 feet.

4. Similar to No. 3, but containing in addition to *Maclurites* various species of *Orthoceras* and larger masses of *Stromatocerium*.

90 feet.

205 feet.

5. Less massive limestones, quite impure, and often disintegrating into nodules as though shaly.

60 feet.

265 feet.

A + B = 575 feet.

Group C: Upper Chazy, 157 feet.

1. Dark, iron-gray dolomite, weathering yellowish.

1 foot.

1 foot.

2. Blue, compact, fine-grained pure limestone, containing fine lines of calcite.

6 feet.

7 feet.

3. Dove-colored, compact, brittle, perfectly pure limestone, containing small nodules of calcite.

5 feet.

12 feet.

4. Iron-gray dolomite.

3½ feet.

15½ feet.

5. Like No. 3, with larger calcite nodules.

4½ feet.

20 feet.

6. Dark gray, fine-grained, compact limestone, somewhat impure, having a mottled aspect when weathered, containing undetermined species of *Murchisonia* and *Orthoceras*.

2 feet.

22 feet.

7. Iron-gray dolomite.

1 foot.

23 feet.

8. Blackish, impure limestone, abounding in *Camarotoechia plena*.

36½ feet.

59½ feet.

9. Gray, massive, coarsely granular limestone, mostly made up of crinoidal fragments, which are sometimes red, containing *Camarotoechia*.

26½ feet.

86 feet.

⁶ *Monotrypella* sp.

| | |
|---------------------------------|-----------|
| 10. Same as No. 8. | |
| 32 feet. | 118 feet. |
| 11. Measures concealed. | |
| 7 feet. | 125 feet. |
| 12. Tough, impure limestone. | |
| 8 feet. | 133 feet. |
| 13. Measures concealed. | |
| 24 feet. | 157 feet. |
| $A + B + C = 732 \text{ feet.}$ | |

The Isle La Motte Section.

At Isle La Motte, Vermont, Brainerd and Seely took the following section:

1. Layers of slate containing *Lingula*⁷ and *Orthis*.⁸
23 feet. 23 feet.
2. Silicious limestone with seams of tough slate containing *Camerella breviplicata*,⁹ *Clitambonites porcia*, *Strophomena aurora*,¹⁰ *Rafinesquina camerata*,¹¹ *Zygospira ? acutirostris*, *Asaphus canalis*,¹² *Pseudo-sphærexochus vulcanus*, *Illænus crassicauda*,¹³ *Remopleurides schlotheimi*.¹⁴
55 feet. 78 feet.
3. Massive beds crowded with *Orthis costalis* (probably *Hebertella exfoliata*).
75 feet. 153 feet.
4. Crinoidal beds with layers of univalves and the layers of red-spotted marble. *Stylaræa parva* occurs near the top.
70 feet. 223 feet.

"The Maclurea beds that follow are like those of the preceding section, but of less thickness.

"The upper portion of Group B is assimilated at Isle La Motte to the lower portion of Group C. It consists of dove-colored, fine-grained limestone, almost devoid of bedding, rarely containing *Maclurites*

⁷ *Lingula brainerdi*.

⁸ *Orthis acutiplicata*.

⁹ Probably *Camerella varians*.

¹⁰ Probably *Rafinesquina incrassata*.

¹¹ Probably *Rafinesquina incrassata*.

¹² Probably *Isotelus harrisi*.

¹³ Probably *Illænus erastusi*.

¹⁴ Probably *Remopleurides canadensis*.

magus, but full of large light-colored wavy masses, resembling *Stromatocerium*. Above this appears the dove-colored limestone with bands of magnesian limestone. We find here *Cyrtoceras boycii*, *Orthoceras titan*, *Placoparia multicostata*,¹⁵ *Lichas champlainensis*,¹⁶ *Illænus* sp. ind. and *Bucania* sp. ind.

"The upper portion of the Chazy is abraded and covered by a marsh. Total thickness probably 640 feet."

Plattsburgh, New York.

The following description of the Chazy outcrops in the vicinity of Plattsburgh, New York, is given by Professor H. P. Cushing in the Report of the New York State Geologist, 1895, pages 503 to 573:

"The Chazy is exposed at Bluff Point and also north of Plattsburgh, where it lies just to the east of the Calciferous exposures. Bluff Point is a conspicuous topographic feature, rising sharply to an altitude of 170 feet above the lake and being the only high ground along the shore in the county. It is a block fault with a resistant stratum on its summit. Nearly the whole middle division and about 100 feet of the lower part are shown here, and, with the Peru section, form a good exhibit of nearly the whole Chazy.

"The whole series is characteristically fossiliferous. Along the lake shore, near the boat-landing, the *Maclurea* beds are shown and also contain a large Strophomenoid form resembling *Rafinesquina alternata*.¹⁷ Other fossils occur.

"The Chazy north of Plattsburgh is much faulted. At the Normal School beds of Lower Chazy age are exposed, and are succeeded just beyond the race track by the lower *Maclurea* beds. These continue a distance of nearly a mile with a sinuous strike. They consist mainly of massive, nearly black limestones, and are largely quarried. With these are thin-bedded, rather shaly bands with an abundant brachiopod fauna.

"Just beyond the three corners, a little over a mile north of Plattsburgh, is an east and west fault bringing up again the upper beds of the lower division on the north side. This is followed by the *Maclurea* beds again, and thence northward the entire *Maclurea* division and a large part of the upper Chazy appear within a mile, the latter well

¹⁵ *Pliomerope canadensis*.

¹⁶ *Amphilichas minganensis*.

¹⁷ *Rafinesquina champlainensis*.

exposed and abundantly fossiliferous. The final exposures are about half a mile from the Beekmantown village line."

The Valcour Island Section.

At Valcour Island, the Chazy is well developed and Brainerd and Seely give the following section: dip 20° to 30° eastward.

Group A: Lower Chazy, 338 feet.

1. Gray- or drab-colored sandstone interstratified with thin (or sometimes thick) layers of slate, and with thin layers of limestone at the base containing *Camerella* (?) *costata* (probably *Orthis acutiplicata*).

56 feet.

56 feet.

2. Massive beds, made up of thin alternating layers of tough slate and nodular limestone, containing undetermined species of *Orthis* and *Orthoceras*.

82 feet.

138 feet.

3. Dark bluish-gray, somewhat impure limestone, in beds of variable thickness, often packed with *Orthis costalis* Hall, which occurs with more or less frequency through the whole mass. Other fossils are *Lingula huronensis*, *Eoharpes antiquatus*, *Eoharpes ottawaënsis*, *Thaleops ovata*, *Lituities* sp. (?).

110 feet.

248 feet.

4. Gray, tolerably pure limestone in beds 8 to 20 inches thick, separated by earthy seams, the bedding being uneven. Many layers consist of crinoidal fragments, largely of *Palæocystites tenuiradiatus*. Near the middle of the mass, for a thickness of 10 feet, some of the fragments and small ovoid masses (*Bolboporites americanus*) are of a bright red color.

90 feet.

338 feet.

Group B: Middle Chazy, 350 feet.

1. Impure, nodular limestone, containing *Maclurites magnus*.

25 feet.

25 feet.

2. Gray, massive, pure limestone, abounding in crinoidal fragments.

20 feet.

45 feet.

3. Bluish-black, thick-bedded limestone, usually weathering so as to show pure nodular masses enveloped in a somewhat impure, light colored matrix; everywhere characterized by *Maclurites magnus*. Near the middle of this mass, for a thickness of about 30 feet, the fossils are

silicified and of a jet black color. The more important beside *Machurites* are species of *Orthis*,¹⁸ *Strophomena*¹⁹ and *Orthoceras*.

210 feet.

255 feet.

4. Dark, compact, fine-grained limestone with obscure bedding, weathering to a light gray. Fossils are infrequent, but at a single locality²⁰ were collected: *Rafinesquina incrassata*, *Isotelus canalis*,²¹ *Ceraurus polydorus*,²² *Eoharpes* sp. und., *Illænus incertus*,²³ *Amphilichas ninganensis*, *Sphærexochus parvus* and several undetermined species.

20 feet.

275 feet.

5. Bluish-black limestone like number 3, but less pure, containing *Machurites magnus*, *Orthis perveta*, *Rafinesquina incrassata*, *Hebertella borealis*.

75 feet.

350 feet.

Group C: Upper Chazy, 202 feet.

1. Dove-colored compact limestone, in massive beds, containing a large *Orthoceras*, *Plimerops canadensis*, *Solenopora compacta*, and a large *Bucania*.

60 feet.

60 feet.

2. Dark impure limestone, in thin beds, abounding in *Camarotoëchia plena*; at the base a bed 4 or 5 feet thick is filled with various forms of *Monticulipora* or *Stenopora*.

125 feet.

185 feet.

3. Tough, arenaceous magnesian limestone, passing into fine-grained sandstone.

17 feet.

202 feet.

$$A + B + C = 890 \text{ feet.}$$

Section at Crown Point, New York.

After Brainerd and Seely.

- | | | | |
|----|---|--|-----------|
| A. | { | 1. Sandstone and slate interstratified. | 23 feet. |
| | { | 2. Impure limestone containing <i>Plasiomys platys</i> . | 25 feet. |
| B. | | Beds containing <i>Machurites magnus</i> . | 200 feet. |

¹⁸ *Plasiomys platys*.

¹⁹ *Rafinesquina champlainensis*.

²⁰ This locality is at Bluff Point.

²¹ *Isotelus harrisi*.

²² *Ceraurus pompilius*.

²³ *Illænus globosus*.

- | | | |
|------|--|----------|
| C. { | 1. Dark-gray, massive limestone weathering in darker stripes an inch wide, containing the large <i>Bucania</i> seen elsewhere in this horizon. | 40 feet. |
| | 2. Tough silicious and magnesian rocks passing into a two-foot bed of pure sandstone. | 17 feet. |

Total A, B, C = 305 feet.

Orwell, Vermont.

An exposure one mile northeast of Orwell village presents 59 feet of dark gray strata lying between the Beekmantown and Black River and containing *Maclurites magnus*, *Orthoceras* and *Cyrtoceras*. While no basal sandstone can be seen at this locality, it is present on the lake shore five or six miles to the northwest.

The Canadian Extension of the Champlain Valley.

Northeast of Chazy in the region of Phillipsburgh, Canada, the Chazy consists of slates, limestones, and limestone conglomerates (Ells), while further north at St. Dominique it is again a limestone (Ells), and at Montreal the formation consists mostly of a heavy-bedded limestone with a little sandstone (Logan, Ami). No very good sections are exposed in the region north of Lake Champlain, and the estimates of thickness differ widely at the various localities, being as high as 2,000 feet around Standbridge and Bedford, according to Ells, and as low as 200 to 300 feet at Montreal, according to Ami.

Summary on Lake Champlain Region.

In this general region the formation consists mostly of an impure limestone, frequently dolomitic, and the thickness decreases from 890 feet at Valcour Island to 60 feet at Orwell. From Ells' statements it is probable that the thickness does not decrease north of the Canadian line. At Montreal, Ami estimates the thickness of all the formations from the Potsdam to the Lorraine, at only 1,275 feet, thus allowing only 300 feet for the Chazy, and about the same for the Beekmantown, but he states that a well boring reached the Potsdam at a depth of 2,500 feet which, if the strata were horizontal, would allow 600 feet for the Chazy and 1,200 for the Beekmantown. The writer is inclined to believe that Dr. Ami has greatly underestimated the thickness of both these formations. (See *Transactions of the Royal Society of Canada*, volume 6, section 4, pages 125-164, 1900.)

Contact with Other Formations.

At various places throughout the Lake Champlain Valley the contacts of the Chazy with the Beekmantown and Lowville formations are exposed. When the Beekmantown-Chazy contact is shown, the upper layers of the Beekmantown are a rather pure dolomite, and the lower layers of the Chazy, which are a dense sandstone or quartzite, lie conformably upon them. At Crown Point, however, the surface of the upper layer of the Beekmantown is irregular and the sandstone of the Chazy fills the depressions in this layer, indicating either an interval of erosion or underground solution. It is probably the former, as will be seen later.

The lower layers of the Chazy are the same throughout the Champlain Valley, as the sandstones at the base are present at Larabee's Point, Crown Point, Valcour Island, South Hero, Isle La Motte and probably at Montreal (Logan).

The contact with the Lowville limestone is not so well shown in any section. Brainerd and Seely state that the highest layer of the Chazy is a two-foot bed of sandstone. This sandstone is well exposed at Crown Point, but as the writer has previously shown,²⁴ it is overlain by a layer of sandy limestone which contains Middle Chazy fossils. At Valcour Island the sandstone is not exposed at ordinarily low water, but that such a sandstone does occur is shown by the fact that fragments of sandstone are found upon the shore just south of the exposure of Lowville and Black River limestones.

THE OTTAWA VALLEY REGION.

The Chazy of this region has been described in detail by Sir William Logan, Ells, and Ami, of the Canadian Geological Survey. It is not more than 200 feet in thickness, usually less, and is divided into two parts, the lower embracing shales and sandstones, and the upper, limestones. In certain sections there are about 20 feet of transition beds in the middle of the formation, where the limestones are interstratified with the shaly portion.

At Greeces Point, on the Grenville canal, the contact between the Calcareous and Chazy can be well seen. Here the dolomitic limestones of the former are overlain by several feet of fine conglomerate or coarse grit. This coarse grit soon graduates into greenish shale and

²⁴ *Bulletin of American Paleontology*, Number 14, page 20.

sandstone with thin partings of dark limestone, which represent the lowest division of the Chazy. The coarse sandstones at the base of the formation in this region point to very shallow water and shore conditions in the Ottawa Valley, and a probable interval of erosion between the end of Beekmantown time and the deposition of the strata of Chazy age. As will be seen later, the fauna also indicates a break between the two formations.

The Chazy formation occurs in a narrow belt extending along the north and south sides of the Ottawa River from Hawkesbury west to Arnprior and is again exposed south of Ottawa and eastward to Cornwall, where it turns northward and connects with the northern belt at Hawkesbury. This belt of Chazy does not connect with the Chazy of the Champlain region. West of Arnprior there are two localities in which there are outcrops of Chazy rocks. One is at Allumette Island, north of Pembroke, and the other ten or fifteen miles south of this and west of Renfrew. In the Ottawa region the Chazy is usually underlain by the Beekmantown and overlain by the Lowville limestone. The Beekmantown is, however, very different lithologically and faunally from that in the Champlain Valley. The contact with the overlying Lowville limestone is not well shown, but the Upper Chazy limestone seems to grade into the buff dolomite of the Lowville formation without a break.

THE MINGAN ISLANDS.

The best account of the Chazy at the Mingan Islands is given by Sir William Logan in the *Geology of Canada*, 1863, page 134. The following quotations will serve to explain the occurrence there.

"The lowest part seen of the deposit occurs in the bay above Clear Water Point and the following is the section of the strata in ascending order:

| | |
|---|---------|
| "Reddish cream-colored, compact limestone with conchoidal fracture; weathering pale yellow. | 1 foot. |
|---|---------|

| | |
|-------------------------------------|---------|
| "Greenish and blackish brown shale. | 1 foot. |
|-------------------------------------|---------|

"Reddish cream-colored limestone, like No. 1, in beds 1 inch to 2 inches to a foot, interstratified with greenish shale in beds of about the same thickness.

| | |
|---|---------|
| "Greenish shale with <i>Camarotoechia orientalis</i> (variety of <i>Camarotoechia plena</i>) in great abundance. | 3 feet. |
|---|---------|

| | |
|--|--|
| "Granular limestone with false bedding, holding comminuted frag- | |
|--|--|

ments of encrinites and other organic remains, including *Bolboporites americanus*, *Camarotæchia orientalis*, a few of *Camerella varians* and other species. 13 feet.

"Gray nodular limestones with *Stylaræa parva*, *Monotrypella*, *Phylloporina incepta*, *Rafinesquina incrassata*, *Ctenodonta nasuta*, *Plectoceras jason*, *Pliomerops canadensis*, *Eoharpes antiquatus*, *Illænus globosus*. 20 feet.

"Gray magnesian limestone with *Lophospira aspera*?, *Maclurites atlanticus*, *Orthoceras multicameratum*, *Orthoceras bilineatum*, *O. natator*, *O. maro*, *O. antenor*, *O. minganensis*, *O. shumardi*, *Illænus bayfieldi* and other fossils." 12 feet.

Total 78 feet.

Another section, occurring on Large Island, is given. It measures 171 feet 5 inches, and from the fact that it is almost devoid of fossils it is suggested that it probably overlies the preceding beds. The strata are nearly all limestone with a little shale, dolomite, and chert. The total thickness of the Chazy, in that region, is estimated at about 300 feet.

The following is the fauna of the Chazy at Mingan Islands, so far as it can be determined from the published lists :

| | |
|----------------------------------|------------------------------------|
| <i>Bolboporites americanus</i> , | <i>Plectoceras jason</i> , |
| <i>Monotrypella</i> sp., | <i>Orthoceras bilineatum</i> , |
| <i>Phylloporina incepta</i> , | <i>Orthoceras antenor</i> , |
| <i>Stylaræa parva</i> , | <i>Orthoceras maro</i> , |
| <i>Fletcheria incerta</i> , | <i>Orthoceras minganensis</i> , |
| <i>Rafinesquina incrassata</i> , | <i>Orthoceras multicameratum</i> , |
| <i>Orthis piger</i> , | <i>Orthoceras natator</i> , |
| <i>Camerella longirostris</i> , | <i>Orthoceras shumardi</i> , |
| <i>Camerella varians</i> , | <i>Eoharpes antiquatus</i> , |
| <i>Camarotæchia orientalis</i> , | <i>Pliomerops canadensis</i> , |
| ? <i>Ctenodonta nasuta</i> , | <i>Illænus globosus</i> , |
| <i>Straparollus</i> sp., | <i>Illænus bayfieldi</i> , |
| <i>Maclurites atlanticus</i> , | <i>Leperditia amygdalina</i> . |
| <i>Lophospira aspera</i> , | |

Of these species, the following occur in the Chazy formation of the Champlain valley :

| | |
|----------------------------------|------------------------------------|
| <i>Bolboporites americanus</i> , | <i>Orthoceras bilineatum</i> , |
| <i>Phylloporina incepta</i> , | <i>Orthoceras multicameratum</i> , |

| | |
|----------------------------------|---------------------------------|
| <i>Stylaræa parva</i> , | <i>Plectoceras jason</i> , |
| <i>Rafinesquina incrassata</i> , | <i>Pliomereops canadensis</i> , |
| <i>Camarotæchia orientalis</i> , | <i>Illænus globosus</i> , |
| <i>Camerella longirostris</i> , | <i>Eoharpes antiquatus</i> . |
| <i>Camerella varians</i> , | |

There is only one species, *Camarotæchia orientalis*, which is common to the Mingan Island fauna and the fauna of the Chazy (Aylmer formation) of the Ottawa valley.

SECTIONS AND FAUNAL LISTS IN THE CHAMPLAIN REGION.

In order to determine the geographic and stratigraphic range of the Chazy species, collections have been made at various points along Lake Champlain, at Montreal, and at Ottawa and Aylmer. It was also desired to study the associations of species as faunules, and to see if these faunules were characteristic of any particular horizon, so that they might be useful in stratigraphic work. As Valcour Island presented the most complete section of any locality near the type section at Chazy, the Valcour Island section has been worked up with much care and will serve as a basis for comparison.

Section A, along the South End of Valcour Island, with Faunal Lists.

The section begins on the south end of the Island, just east of the most southern fault marked on Brainerd and Seely's map, and runs northeast along the shore to the southeast point of Valcour Island. No attempt was made to collect from every layer, but the strata were carefully measured and wherever fossils were numerous a full collection was made, thus showing the fauna at thirty-nine stations in the 614 feet of layers actually exposed along the line of this section.

A₁. A dense, hard quartzite in thin layers with shaly partings. The sandstone is full of fragments of *Lingulæ*. This may not be the actual base of the formation, but comprises the lowest layers exposed at low water in the seasons the writer has spent at Valcour Island. Professor Hudson informs me that he has been able to sample still lower layers which seem to be similar. 3 feet = 3 feet.

Lingula brainerdi c.²⁵

A₂. A foot of non-fossiliferous greenish shale. 1 foot = 4 feet.

²⁵ The usual signs will be used to show the relative abundance of the species; a = abundant, c = common, r = rare, R = very rare.

A₃. A very hard, dense sandstone containing many fragments of *Lingulæ*. Full of pyrite, by which mineral some of the fossils are replaced. 7 feet = 11 feet.

Lingula brainerdi c, *Orthoceras* sp.,
Eccyliopterus ? sp., *Isotelus harrisi* r.

A₄. Shale with thin layers and nodules of sandstone.

3 feet 10 inches = 14 feet 10 inches.

A₅. Heavy-bedded, magnesian limestone, containing some sand. Fossils numerous. Local unconformity.

3 feet 9 inches = 18 feet 7 inches,

Rhinidictya fenestrata r, *Camerella longirostris* c,
 Unidentified bryozoan r, *Zygospira* ? *acutirostris* r,
Orthis acutiplicata c, *Archinacella* ? *propria* r,
Orthidium lamellosum c, *Isotelus harrisi* c,
Hebertella sp. c, *Thaleops ovata* r,
Rafinesquina alternata r, *Pterygometopus annulatus* r.

A₆. Thin-bedded, sandy dolomite with shaly partings. No fossils.

3 feet 2 inches = 21 feet 9 inches.

A₇. Heavy-bedded, sandy limestone. No fossils.

10 feet 6 inches = 32 feet 3 inches.

A₈. Rather pure, crystalline limestone in thin uneven beds. Fossils few. Extends to top of bluff. Plate XXIV.

8 feet 4 inches = 40 feet 7 inches.

At base: *Isotelus harrisi* r. Crinoid stems.

The top foot is made up of fragments of shells which have evidently been broken up by washing about on a beach. There is much crystalline calcite.

Phylloporina incepta r, *Isotelus harrisi* c,
Hebertella exfoliata a, *Leperditia canadensis* r.
Zygospira ? *acutirostris* c,

A₉. Sandy magnesian limestone with a couple of one foot beds of shale. Many fucoids. 7 feet 10 inches = 48 feet 5 inches.

A₁₀. Shaly, impure limestone. No fossils.

4 feet = 52 feet 5 inches.

A₁₁. Impure, nodular limestone. The top of this zone marks the top of Brainerd and Seely's zone A₁.

4 feet 9 inches = 57 feet 2 inches.

A₁₂. This zone extends to the top of the cliff where the ledges turn north and the steep dip begins to show. The bottom foot consists of shale and sandstone in bands about two inches thick. Above it are 28 feet of impure limestone. The upper five feet are cherty limestones with numerous fossils.

34 feet = 91 feet 2 inches.

| | |
|----------------------------------|-------------------------------------|
| <i>Phylloporina incepta</i> r, | <i>Zygospira acutirostris</i> c, |
| <i>Monotrypella</i> sp. r, | <i>Isotelus harrisi</i> c, |
| <i>Hebertella exfoliata</i> c, | <i>Asaphus beta</i> r, |
| <i>Hebertella vulgaris</i> r, | <i>Illænus punctatus</i> r, |
| <i>Orthis</i> sp. ind. c, | <i>Leperditia canadensis</i> c, |
| <i>Rafinesquina alternata</i> r, | <i>Eurychilina latimarginata</i> c. |

A₁₃. Impure nodular limestone with much slaty shale. The fossils are from the upper five feet.

25 feet = 116 feet 2 inches.

| | |
|---------------------------------------|----------------------------------|
| <i>Hebertella exfoliata</i> c, | <i>Orthoceras tenuiseptum</i> r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Isotelus harrisi</i> r, |
| <i>Bucania sulcatina</i> r, | <i>Pliomerops canadensis</i> r. |
| <i>Orthoceras rectiannulatum</i> c. | |

A₁₄. Lithological characters same as the preceding.

31 feet 7 inches = 147 feet 9 inches.

| | |
|---------------------------------------|-------------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Strophomena prisca</i> c, |
| <i>Bolboporites americanus</i> a, | <i>Orthoceras rectiannulatum</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Isotelus harrisi</i> c, |
| <i>Hebertella vulgaris</i> c, | <i>Pliomerops canadensis</i> c. |
| <i>Rafinesquina alternata</i> r, | |

A₁₅. Covered along pebble beach.

About 133 feet = 280 feet 9 inches.

A₁₆. Thin-bedded, dark-gray, quite pure limestone with very few fossils.

20 feet = 300 feet 9 inches.

A₁₇. Bluish-gray, thin-bedded limestone which is more coarsely crystalline than the preceding. The weathered edges of the layers show many fossils, mostly sponges and bryozoa.

13 feet = 313 feet 9 inches.

A₁₈. Thin-bedded, fairly pure, light-gray limestone containing many fossils.

18 feet = 331 feet 9 inches.

| | |
|---------------------------------------|---|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Camerella varians</i> r, |
| <i>Bolboporites americanus</i> r, | <i>Asaphus alpha</i> c, |
| <i>Phylloporina incepta</i> c, | <i>Asaphus beta</i> r, |
| <i>Rhinidictya fenestrata</i> c, | <i>Asaphus gamma</i> r, |
| <i>Hebertella exfoliata</i> r, | <i>Isotelus obtusum</i> r, |
| <i>Rafinesquina incrassata</i> r, | <i>Isotelus harrisi</i> c, |
| <i>Rafinesquina distans</i> r, | <i>Illænus globosus</i> a, |
| <i>Rafinesquina champlainensis</i> r, | <i>Thaleops ovata</i> r, |
| <i>Clitambonites multicosta</i> r, | <i>Pliomerops canadensis</i> r, |
| <i>Ctenodonta peracuta</i> r, | <i>Pseudosphærexochus chazyensis</i> r, |
| <i>Holopea</i> sp. ind. r, | <i>Pterygometopus annulatus</i> c, |
| <i>Eoharpes antiquatus</i> c, | <i>Leperditia canadensis</i> a, |
| <i>Lonchodomas halli</i> r, | <i>Eurychilina latimarginata</i> c. |

A₁₉. Dark-blue, irregularly bedded, fine-grained limestone with shaly partings. Fossils same as A₂₀.

13 feet 6 inches = 345 feet 3 inches.

A₂₀. Heavy-bedded, fairly pure blue-black limestone, with much shaly matter between layers. Forms top of the first bluff east of "Pebble beach." Fossils are semi-silicified and weather out readily.

20 feet 6 inches = 365 feet 9 inches.

| | |
|---------------------------------------|--------------------------------------|
| <i>Strophochetus</i> sp. und. c, | <i>Holopea scrutator</i> r, |
| <i>Eospongia varians</i> r, | <i>Clathrospira obsoletum</i> r, |
| <i>Malocystites murchisoni</i> c, | <i>Trochonema dispar</i> c, |
| <i>Malocystites</i> sp. r, | <i>Bucania bidorsata</i> ? r, |
| <i>Monotrypella</i> sp. r, | <i>Bucania sulcatina</i> c, |
| <i>Bryozoa</i> , 2 species c, | <i>Lophospira subabbreviata</i> , c, |
| <i>Hebertella vulgaris</i> c, | <i>Trochonema rectangularis</i> r, |
| <i>Hebertella</i> sp. nov. c, | <i>Eccyliopterus fredericus</i> r, |
| <i>Plasiomys strophomenoides</i> c, | <i>Orthoceras</i> , 2 species, |
| <i>Plasiomys platys</i> r, | <i>Eoharpes ottawaënsis</i> r, |
| <i>Rafinesquina alternata</i> r, | <i>Lonchodomas halli</i> c, |
| <i>Rafinesquina champlainensis</i> c, | <i>Isotelus obtusum</i> c, |
| <i>Camerella varians</i> r, | <i>Isotelus harrisi</i> r, |
| <i>Camerella longirostris</i> r, | <i>Thaleops ovata</i> c, |
| <i>Ctenodonta peracuta</i> r, | <i>Pliomerops canadensis</i> r, |
| <i>Clionychia montrealensis</i> r, | <i>Sphærexochus parvus</i> c, |
| <i>Raphistoma striatum</i> r, | <i>Cybele primus</i> r, |
| <i>Raphistoma stamineum</i> c, | <i>Amphilichas minganensis</i> r, |
| <i>Maclurites magnus</i> c, | <i>Pterygometopus annulatus</i> c. |

A₂₁. One bed of dark-blue, very compact limestone.

8 feet = 373 feet 9 inches.

A₂₂. Heavy-bedded, blue limestone, containing silicified fossils.

18 feet = 391 feet 9 inches.

| | |
|---------------------------------------|-------------------------------------|
| <i>Bolboporites americanus</i> r, | <i>Lonchodomas halli</i> c, |
| <i>Plæsiomys platys</i> c, | <i>Asaphus alpha</i> r, |
| <i>Hebertella</i> sp. r, | <i>Asaphus beta</i> c, |
| <i>Rafinesquina alternata</i> r, | <i>Isotelus harrisi</i> r, |
| <i>Rafinesquina champlainensis</i> r, | <i>Illæmus globosus</i> c, |
| <i>Camerella longirostris</i> c, | <i>Pterygometopus annulatus</i> r, |
| <i>Zygospira acutirostris</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Endodesma tranceps</i> c, | <i>Leperditia limatula</i> r, |
| <i>Lophospira</i> sp. ind. r, | <i>Eurychilina latimarginata</i> r. |
| <i>Maclurites magnus</i> c, | |

A₂₃. Like the preceding, but the fossils are not silicified.

41 feet = 432 feet 9 inches.

A₂₄. Blue, heavy-bedded, somewhat impure limestone, containing an abundance of *Maclurites magnus*. This zone extends to the beginning of the little cove where it is possible to descend to the water's edge.

18 feet = 450 feet 9 inches.

| | |
|---------------------------------------|---------------------------------|
| Unidentified coral c, | <i>Trochonema hudsoni</i> r, |
| <i>Paleocystites tenuiradiatus</i> c, | <i>Maclurites magnus</i> c, |
| <i>Rhinidictya fenestrata</i> c, | <i>Isotelus harrisi</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Thaleops ovata</i> r, |
| <i>Plæsiomys platys</i> r, | <i>Leperditia canadensis</i> r, |
| <i>Camerella varians</i> r, | <i>Leperditia limatula</i> r. |
| <i>Rafinesquina champlainensis</i> r, | |

A₂₅. Rock about the same as the preceding. Fossils not abundant and very difficult to extract. 21 feet 6 inches = 472 feet 3 inches.

A₂₆. Heavy-bedded, blue-gray, impure limestone, containing large black silicified fossils. This zone seems to correspond to the middle of B₃ of Brainerd and Seely's section.

18 feet 6 inches = 490 feet 9 inches.

| | |
|---------------------------------------|-------------------------------------|
| <i>Hebertella vulgaris</i> r, | <i>Orthoceras</i> sp. und. r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Illæmus erastusi</i> r, |
| <i>Ambonychia curvata</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Maclurites magnus</i> c, | <i>Eurychilina latimarginata</i> r. |
| <i>Lophospira perangulata</i> r, | |

A₂₇. Black, impure, heavy-bedded limestone containing *Maclurites magnus*. Extends to the second cove where it is possible to descend to the water's edge. Fossils were obtained from the lower twenty feet and the upper five feet. 84 feet = 574 feet 9 inches.

Fossils from the lower twenty feet are as follows :

| | |
|---------------------------------------|---------------------------------|
| <i>Hebertella vulgaris</i> r, | <i>Maclurites magnus</i> c, |
| <i>Hebertella</i> sp. r, | <i>Thaleops ovata</i> r, |
| <i>Plasiomys platys</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Rafinesquina champlainensis</i> c, | <i>Leperditia limatula</i> r. |

In the upper five feet the following were the common forms :

| | |
|---------------------------------------|------------------------------------|
| <i>Monotrypella</i> sp. c, | <i>Isotelus harrisi</i> c, |
| <i>Rhinidictya fenestrata</i> r, | <i>Illænus globosus</i> r, |
| <i>Bryozoan</i> sp. ind. r, | <i>Thaleops ovata</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Pterygomotopus annulatus</i> r, |
| <i>Plasiomys platys</i> c, | <i>Leperditia canadensis</i> c, |
| <i>Rafinesquina champlainensis</i> r, | <i>Leperditia limatula</i> r. |
| <i>Camerella varians</i> r, | |

A₂₈. Beds of gray, nodular, impure limestone. Fossils not abundant. 24 feet = 598 feet 9 inches.

| | |
|-----------------------------|-------------------------------------|
| <i>Plasiomys platys</i> c, | <i>Leperditia canadensis</i> c, |
| <i>Maclurites magnus</i> c, | <i>Eurychilina latimarginata</i> r. |

A₂₉. Impure shaly limestone. 17 feet 6 inches = 616 feet 3 inches.

A₃₀. Impure, thin-bedded limestone with occasional thin beds of shale ; exposed in face of cliff just before reaching the point where the shore line turns north. 76 feet 9 inches = 693 feet.

The fossils found in the basal five feet are :

| | |
|---------------------------------------|-------------------------------------|
| <i>Malocystites</i> sp. ind. r, | <i>Lonchodomas halli</i> r, |
| <i>Plasiomys platys</i> c, | <i>Asaphus beta</i> r, |
| <i>Rafinesquina alternata</i> r, | <i>Isotelus harrisi</i> c, |
| <i>Rafinesquina champlainensis</i> c, | <i>Illænus punctatus</i> r, |
| <i>Camerella varians</i> r, | <i>Pterygomotopus annulatus</i> c, |
| <i>Ctenodonta peracuta</i> r, | <i>Leperditia canadensis</i> a, |
| <i>Maclurites magnus</i> c, | <i>Leperditia limatula</i> c, |
| <i>Lophospira</i> sp. ind. r, | <i>Eurychilina latimarginata</i> r. |
| <i>Raphistoma stamineum</i> r, | |

About thirty feet above the base a nodular layer yielded :

| | |
|------------------------------|-----------------------------|
| <i>Monotrypella</i> sp. c, | <i>Maclurites magnus</i> c, |
| <i>Fletcheria incerta</i> r, | <i>Illænus erastusi</i> r. |

In a hard, light-gray, crystalline limestone, near the top, we found :

| | |
|----------------------------------|-----------------------------------|
| <i>Malocystites</i> sp. ind. r, | <i>Hebertella vulgaris</i> c, |
| <i>Stylaræa parva</i> c, | <i>Rafinesquina incrassata</i> c, |
| <i>Fletcheria incerta</i> r, | <i>Maclurites magnus</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Isotelus harrisi</i> c, |
| <i>Rhinidictya fenestrata</i> r, | <i>Illænus globosus</i> r, |
| <i>Plæsiomys platys</i> c, | <i>Thaleops ovata</i> r. |

A₃₁. Impure shaly and nodular layers with many fossils.

15 feet = 708 feet.

| | |
|---------------------------------------|----------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Camerella longirostris</i> r, |
| <i>Stylaræa parva</i> r, | <i>Bucania sulcatina</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Raphistoma stamineum</i> r, |
| <i>Plæsiomys platys</i> c, | <i>Maclurites magnus</i> c, |
| <i>Hebertella borealis</i> c, | <i>Isotelus harrisi</i> r, |
| <i>Rafinesquina incrassata</i> r, | <i>Leperditia canadensis</i> c. |

A₃₂. One bed of rather pure blue limestone with few fossils.

10 feet 6 inches = 718 feet 6 inches.

A₃₃. Impure nodular limestone with many fossils which are difficult to extract. The nodules usually contain massive bryozoans or corals.

10 feet 6 inches = 729 feet.

| | |
|---------------------------------------|-------------------------------------|
| <i>Paleocystites tenuiradiatus</i> r, | <i>Camarotoechia plena</i> r, |
| Crinoidal columns c, | <i>Lophospira perangulata</i> r, |
| <i>Stylaræa parva</i> c, | <i>Orthoceras multicameratum</i> r, |
| Coral sp. ind. c, | <i>Isotelus obtusum</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Isotelus harrisi</i> r, |
| Bryozoan sp. ind. c, | <i>Pliomerops canadensis</i> r, |
| <i>Plæsiomys platys</i> c, | <i>Leperditia canadensis</i> r, |
| <i>Rafinesquina incrassata</i> r, | <i>Eurychilina latimarginata</i> r. |
| <i>Orthidium lamellosum</i> r, | |

A₃₄. Light-colored, coarsely crystalline limestone, in which *Camarotoechia plena* is abundant.

9 feet = 738 feet.

| | |
|----------------------------------|-------------------------------------|
| <i>Rhinidictya fenestrata</i> c, | <i>Rafinesquina alternata</i> c, |
| <i>Phylloporina incepta</i> r, | <i>Rafinesquina incrassata</i> c, |
| <i>Monotrypella</i> sp. c, | <i>Camarotoechia plena</i> a, |
| Bryozoan sp. ind. r, | <i>Isotelus harrisi</i> c, |
| <i>Lingula</i> sp. ind. r, | <i>Leperditia canadensis</i> a, |
| <i>Hebertella vulgaris</i> c, | <i>Eurychilina latimarginata</i> c. |

A₃₅. Thin-bedded, pure-black layers, with shaly partings and a few three- or four-inch beds of shale. 10 feet = 748 feet.

| | |
|----------------------------------|---------------------------------|
| <i>Monotrypella</i> sp. c, | <i>Raphistoma stamineum</i> r, |
| <i>Lingula</i> sp. ind. r, | <i>Isotelus harrisi</i> r, |
| <i>Plesiomys platys</i> r, | <i>Pliomerops canadensis</i> r, |
| <i>Camarotoechia plena</i> c, | <i>Leperditia canadensis</i> r. |
| <i>Camerella longirostris</i> r, | |

A₃₆. Light-gray crystalline limestone. The top foot and a fifteen-inch layer at the bottom are cross-bedded. The fossils are from near the middle of the zone. 7 feet 4 inches = 755 feet 4 inches.

| | |
|----------------------------------|-------------------------------------|
| <i>Rhinidictya fenestrata</i> r, | <i>Amphilichas minganensis</i> r, |
| <i>Lingula</i> sp. ind. c, | <i>Leperditia canadensis</i> c, |
| <i>Hebertella vulgaris</i> c, | <i>Eurychilina latimarginata</i> r. |
| <i>Camarotoechia plena</i> c, | |

A₃₇. Impure fossiliferous limestone in thin layers.

12 feet = 767 feet 4 inches.

| | |
|----------------------------------|-------------------------------------|
| <i>Monotrypella</i> sp. c, | <i>Modiolopsis fabaformis</i> r, |
| <i>Phylloporina incepta</i> r, | <i>Raphistoma stamineum</i> c, |
| <i>Lingula</i> sp. ind. r, | <i>Bucania sulcatina</i> r, |
| <i>Plesiomys platys</i> c, | <i>Isotelus harrisi</i> c, |
| <i>Hebertella vulgaris</i> c, | <i>Asaphus beta</i> r, |
| <i>Camerella longirostris</i> r, | <i>Leperditia canadensis</i> r, |
| <i>Camarotoechia plena</i> c, | <i>Eurychilina latimarginata</i> c. |
| <i>Camarotoechia major</i> r, | |

A₃₈. Coarse-grained, dark-blue limestone with many specimens of *Bucania sulcatina* showing on the weathered surface.

8 feet = 775 feet 4 inches.

| | |
|---------------------------------------|-------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Maclurites magnus</i> r, |
| <i>Stylarica parva</i> c, | <i>Orthoceras</i> sp. ind. c, |
| <i>Monotrypella</i> sp. c, | <i>Lonchodomas halli</i> r, |



Northeast shore of Valcour Island, Section C.

G. H. HUESON, PHOTO.

| | |
|-----------------------------------|-------------------------------------|
| <i>Hebertella vulgaris</i> c, | <i>Asaphus alpha</i> r, |
| <i>Orthidium lamellosum</i> c, | <i>Isotelus harrisi</i> c, |
| <i>Rafinesquina incrassata</i> r, | <i>Illænus globosus</i> c, |
| <i>Camarotoechia plena</i> a, | <i>Amphilichas minganensis</i> r, |
| <i>Modiolopsis fabaformis</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Bucania sulcatina</i> c, | <i>Leperditia limatula</i> r, |
| <i>Raphistoma stamineum</i> r, | <i>Eurychilina latimarginata</i> r. |

A₃₉. Impure nodular limestone with a great quantity of fine shale. Forms the southeast point of Valcour Island and is locally known as Cystid Point. 14 feet = 789 feet 4 inches.

| | |
|------------------------------------|-------------------------------------|
| <i>Malocystites emmonsii</i> c, | <i>Raphistoma stamineum</i> r, |
| <i>Malocystites</i> sp. c, | <i>Lophospira</i> sp. r, |
| <i>Paleocystites</i> 2 sp. r, | <i>Conularia triangulata</i> r, |
| <i>Monotrypella</i> sp. a, | <i>Orthoceras rectiannulatum</i> c, |
| <i>Lingula columba</i> r, | <i>Orthoceras tenuiseptum</i> r, |
| <i>Orthis ignicula</i> r, | <i>Orthoceras</i> sp. ind. r. |
| <i>Hebertella vulgaris</i> c, | <i>Eoharpes ottawaënsis</i> r, |
| <i>Plesiomys platys</i> r, | <i>Isotelus harrisi</i> r, |
| <i>Rafinesquina incrassata</i> r, | <i>Illænus globosus</i> c, |
| <i>Camarotoechia plena</i> a, | <i>Thaleops ovata</i> c, |
| <i>Camarotoechia major</i> r, | <i>Pliomerops canadensis</i> c, |
| <i>Clionychia montrealensis</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Ambonychia curvata</i> r, | <i>Eurychilina latimarginata</i> r. |
| <i>Bucania sulcatina</i> r, | |

End of Section A.

Valcour Island, Section C.

This section begins with the lowest layers exposed north of the great fault which comes out in Bay Beauty, and extends to the most northern point on the Island. It includes a part of the upper Chazy to the base of the Lowville limestone, but the actual contact is not exposed, and some of the upper Chazy layers are covered by soil and the lake. The rock is mostly a thin-bedded, light-gray limestone and is characterized by a great abundance of *Camarotoechia plena*. See plate XXII.

C₁. Thin-bedded, very fossiliferous, light-gray limestone.

3 feet 10 inches = 3 feet 10 inches.

| | |
|-------------------------------|----------------------------|
| <i>Monotrypella</i> sp. c, | <i>Isotelus harrisi</i> r, |
| <i>Camarotoechia plena</i> a, | <i>Illæmus globosus</i> r. |
| <i>Bucania sulcatina</i> r, | |

C₂. Same as C₁ but containing more specimens of *Camarotoechia plena*.
3 feet 8 inches = 7 feet 6 inches.

| | |
|-------------------------------|----------------------------------|
| <i>Camarotoechia plena</i> a, | <i>Modiolopsis fabaformis</i> r. |
| <i>Isotelus harrisi</i> r, | |

C₃. Cross-bedded, light-gray limestone, made up of comminuted fossils.
1 foot = 8 feet 6 inches.

| | |
|-------------------------------|----------------------------------|
| <i>Camarotoechia plena</i> a, | <i>Modiolopsis fabaformis</i> r. |
|-------------------------------|----------------------------------|

C₄. Bluish-gray, fine-grained crystalline limestone, the top four inches cross-bedded.
2 feet = 10 feet 6 inches.

| | |
|----------------------------------|----------------------------|
| <i>Camarotoechia plena</i> aa, | <i>Monotrypella</i> sp. r. |
| <i>Modiolopsis fabaformis</i> r, | |

C₅. Light-gray limestone in compact layers about six inches thick.
2 feet 6 inches = 13 feet.

| | |
|--------------------------------|----------------------------------|
| <i>Camarotoechia plena</i> aa, | <i>Modiolopsis fabaformis</i> r. |
|--------------------------------|----------------------------------|

C₆. Thin-bedded, gray limestone, full of *Camarotoechia plena*.
1 foot 10 inches = 14 feet 10 inches.

| | |
|----------------------------------|----------------------------|
| <i>Camarotoechia plena</i> aa, | <i>Isotelus harrisi</i> r, |
| <i>Camerella longirostris</i> r, | <i>Asaphus alpha</i> r. |

C₇. Light-gray crystalline layers made up of fragments of shells. There is a dike two feet wide which crosses this zone along a joint crack. Its direction is N. 65° W. There is a fault of 1 foot 11 inches between the two walls enclosing the dike, with the down-throw to the north.
5 feet 4 inches = 20 feet 2 inches.

| | |
|----------------------------------|----------------------------------|
| <i>Hebertella vulgaris</i> r, | <i>Isotelus harrisi</i> c, |
| <i>Hebertella</i> sp. r, | <i>Illæmus globosus</i> r, |
| <i>Rafinesquina alternata</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Camarotoechia plena</i> aa, | <i>Modiolopsis fabaformis</i> r. |

C₈. Thicker-bedded, light-gray limestone with much calcite. A two-inch dike crosses this zone parallel to the larger one in C₇.
5 feet 6 inches = 25 feet 8 inches.

| | |
|--------------------------------|------------------------------------|
| <i>Phylloporina incepta</i> r, | <i>Camarotoechia plena</i> a, |
| <i>Monotrypella</i> sp. c, | <i>Modiolopsis fabaformis</i> c, |
| <i>Rafinesquina distans</i> c, | <i>Isotelus harrisi</i> r, |
| <i>Orthidium lamellosum</i> r, | <i>Pterygometopus annulatus</i> r. |

C₉. Thin-bedded gray layers capped by a heavy bed of pure blue limestone. 6 feet 10 inches = 32 feet 6 inches.

| | |
|-------------------------------|----------------------------|
| <i>Lingula columba</i> r, | <i>Isotelus harrisi</i> c. |
| <i>Camarotoechia plena</i> a, | |

C₁₀. About 200 feet northeast of this last outcrop there is a little point with rocks whose strike and dip are similar to the preceding. The layers are of very hard magnesian limestone, fairly coarse-grained, buff on the weathered surface and blue on a fresh fracture three or four inches in from the surface. This layer is about thirty-five feet above C₉ and about ten feet below the Lowville limestone (C₁₁). A few fragmentary fossils were seen in this layer but the only identifiable one was *Eurychilina latimarginata*.

For a little less than a hundred feet beyond this little point the rocks are covered except at very low water. Brainerd and Seely, in their section, mention a fine-grained sandstone as resting above the tough magnesian limestone (C₁₀) but at ordinary low water it has not been possible to locate this during the last five seasons.

C₁₁. Lowville limestone. About ten feet above the tough dolomitic layers last described the pure buff dolomite typical of the "Birds-eye" formation is encountered. It contains no fossils, but is full of calcite lines similar to the *Phytopsis*. The thickness is at least four feet, probably more, but not over ten feet at the most.

C₁₂. On the extreme end of the point is a pure-black limestone with conchoidal fracture. The transition from the Lowville to the Black River is here as abrupt and strongly marked as it is in the Moshier Quarry at Newport in the Mohawk Valley. There is no line of bedding between the two, but a sudden and complete change from *buff* to *black* on the line of contact. The Black River at this point is five feet thick, and contains a few fossils. They are:

| | |
|----------------------------------|--------------------------------|
| <i>Stromatocerium rugosum</i> c, | <i>Leperditia fabulites</i> c, |
| <i>Strophomena incurvata</i> r, | <i>Isotelus</i> sp. r, |
| <i>Orthoceras</i> sp. ind. r, | <i>Thaleopsis ovata</i> r. |

Section D, Valcour Island.

This section begins back of the farm-house on the northwest corner of the Island, and extends to the point at the north end, where the Black River limestone is exposed. D₁ is the lowest exposed layer to the north of the great fault, which crosses Valcour Island from the upper farm-house to Bay Beauty.

D₁. Heavy-bedded, impure nodular limestone with fucoidal markings. Exposed at base of cliff along shore near the farm-house.

7 feet = 7 feet.

| | |
|---------------------------------------|------------------------------------|
| <i>Malocystites</i> sp. r, | <i>Oncoceras</i> sp. r, |
| <i>Plesiomys platys</i> c, | <i>Orthoceras</i> sp. r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Asaphus alpha</i> r, |
| <i>Camerella longirostris</i> r, | <i>Isotelus obtusum</i> r, |
| <i>Camerella varians</i> r, | <i>Isotelus harrisi</i> r, |
| <i>Modiolopsis</i> sp. r, | <i>Isotelus angusticaudum</i> r, |
| <i>Lophospira perangulata</i> r, | <i>Thaleops ovata</i> r, |
| <i>Holopea scrutator</i> r, | <i>Pterygometopus annulatus</i> r, |
| <i>Archinacella ? deformata</i> c, | <i>Leperditia canadensis</i> c. |
| <i>Raphistoma stamineum</i> c, | |

D₂. Thin-bedded, shaly and nodular limestone with thin layers of shale.

18 feet 6 inches = 25 feet 6 inches.

| | |
|---------------------------------------|-----------------------------------|
| <i>Palæocystites tenuiradiatus</i> c, | <i>Archinacella ? deformata</i> , |
| <i>Plesiomys platys</i> r, | <i>Bucania sulcatina</i> r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Helicotoma vagrans</i> r, |
| <i>Camarotoechia pristinus</i> c, | <i>Maclurites magnus</i> c, |
| <i>Camerella longirostris</i> c, | <i>Orthoceras</i> sp. r, |
| <i>Modiolopsis</i> sp. r, | <i>Isotelus harrisi</i> c, |
| <i>Lophospira perangulata</i> c, | <i>Leperditia canadensis</i> c. |

D₃. Impure shaly limestone.

2 feet 9 inches = 28 feet 3 inches.

| | |
|---------------------------------------|-------------------------------------|
| <i>Malocystites</i> sp. c, | <i>Orthoceras rectiannulatum</i> r, |
| Coral sp. ind. r, | <i>Orthoceras</i> sp. r, |
| <i>Monotrypella</i> sp. c, | <i>Cyrtoceras boycii</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Isotelus harrisi</i> r, |
| <i>Rafinesquina champlainensis</i> r, | <i>Illænus globosus</i> r, |
| <i>Bucania sulcatina</i> r, | <i>Illænus crastusi</i> r, |
| <i>Lophospira subabbreviata</i> r, | <i>Thaleops ovata</i> r, |
| <i>Maclurites magnus</i> r | <i>Leperditia canadensis</i> r. |
| <i>Plesiomys platys</i> r, | |

D₄. Impure shaly limestone in which no fossils, except fucoids and *Paleocystites tenuiradiatus*, were found.

3 feet 6 inches = 31 feet 9 inches.

D₅. Dark-gray, heavy-bedded nodular limestone.

3 feet = 34 feet 9 inches.

| | |
|---------------------------------------|-------------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Raphistoma stamineum</i> r, |
| Crinoid anchors, | <i>Hormatoma</i> sp. r, |
| <i>Monotrypella</i> sp. r, | <i>Bucania sulcatina</i> c, |
| <i>Platysomys platys</i> r, | <i>Pterygomotopus annulatus</i> r, |
| <i>Rafinesquina champlainensis</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Camerella longirostris</i> r, | <i>Leperditia limatula</i> r, |
| <i>Camerella varians</i> r, | <i>Eurychilina latimarginata</i> r. |

D₆. Impure, black, irregularly bedded limestone.

1 foot 9 inches = 36 feet 6 inches.

| | |
|----------------------------|---------------------------------------|
| <i>Monotrypella</i> sp. r, | <i>Rafinesquina champlainensis</i> c, |
| <i>Malocystites</i> sp. c, | <i>Plomerops canadensis</i> r. |

D₇. Covered. 2 feet = 38 feet 6 inches.

D₈. Very impure, dark-gray, nodular limestone.

3 feet 5 inches = 41 feet 11 inches.

| | |
|---------------------------------------|------------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Helicotoma vagrans</i> r, |
| <i>Monotrypella</i> sp. r, | <i>Archinacella ? deformata</i> r, |
| <i>Rafinesquina champlainensis</i> r, | <i>Thaleops ovata</i> r. |

D₉. Irregularly bedded, dark-gray limestone.

2 feet 5 inches = 44 feet 4 inches.

| | |
|----------------------------------|---------------------------------|
| <i>Monotrypella</i> sp. r, | <i>Bucania bidorsata ?</i> r, |
| <i>Lingula belli</i> r, | <i>Maclurites magnus</i> r, |
| <i>Rafinesquina alternata</i> r, | <i>Isotelus obtusum</i> c, |
| <i>Raphistoma</i> sp. r, | <i>Illænus globosus</i> r, |
| <i>Raphistoma stamineum</i> r, | <i>Plomerops canadensis</i> r, |
| <i>Bucania sulcatina</i> c, | <i>Leperditia canadensis</i> r. |

D₁₀. One bed of impure, dark-gray limestone, with very few fossils.

2 feet = 46 feet 4 inches.

D₁₁. Covered across to northeast point of the island.

95 feet = 141 feet 4 inches.

D₁₂. Light-gray crystalline limestone with many specimens of *Camerothecia plena*.

2 feet = 143 feet 4 inches.

Monotrypella sp. r,
Hebertella vulgaris a,

Camarotoechia plena a.

D₁₃. Covered. 5 feet 6 inches = 148 feet 10 inches.

D₁₄. Same as D₁₂ but the fossils are usually crushed.
 2 feet 3 inches = 151 feet 1 inch.

Monotrypella sp. r,
Hebertella vulgaris c,

Camarotoechia plena a,
Isotelus sp. r.

D₁₅. Mostly covered. About one foot of the same material as D₁₄ is exposed.
 6 feet 3 inches = 157 feet 4 inches.

Hebertella vulgaris c,
Camerella varians r,
Camerella longirostris r,

Camarotoechia plena c,
Isotelus sp. r,
Pterygometopus annulatus r.

D₁₆. Light-gray, thin-bedded, fine-grained limestone. Much jointed.
 6 feet = 163 feet 4 inches.

Malocystites sp. r,
Phylloporina incepta c,
Monotrypella sp. a,
Hebertella vulgaris c,
Rafinesquina alternata r,
Camerella longirostris r,

Camarotoechia plena a,
Bucania sulcatina r,
Isotelus harrisi r,
Illænus globosus c,
Asaphus alpha r,
Eurychilina latimarginata r.

D₁₇. Covered to the next point east. 69 feet = 232 feet 4 inches.

D₁₈. Light-gray, compact, coarse-grained limestone, in layers six to eight inches thick.
 9 feet 8 inches = 242 feet.

Phylloporina incepta r,
Hebertella sp. r,
Rafinesquina alternata r,
Camerella longirostris r,
Camarotoechia plena aa,

Modiolopsis fabaformis c,
Ciönychia montrealensis r,
Isotelus sp. r,
Leperditia canadensis c.

D₁₉. Unevenly bedded, impure, coarse-grained limestone.
 3 feet 2 inches = 245 feet 2 inches.

Monotrypella sp. r,
Camarotoechia plena a,

Isotelus obtusum c.

D₂₀. Fine-grained, light-gray, crystalline limestone, made up of broken shells.
 4 feet = 249 feet 2 inches.

Camarotoechia plena r,
Isotelus harrisi c,

Leperditia canadensis c.

D₂₁. Covered to point on which the Lowville and Black River limestones are exposed.

Remarks on the Valcour Island Sections.

Correlation of Sections. — The section on the south end of Valcour Island (Section A) does not extend to the top of the formation and it is therefore necessary to supplement it with sections taken on the north end of the island where the upper beds are well exposed. Section D begins in the middle Chazy and extends through the whole upper Chazy, but a large part of the strata are covered. Section C is a short one, but exhibits about thirty-five feet of the upper beds not exposed in either of the other sections.

D₁₋₁₀ correspond to part of A₃₀, C₁₋₉ come about twenty-five feet above A₂₉, and D₁₈₋₂₀ come directly above C₁₋₉, thus making a tolerably complete exposure of all the beds of the Chazy. The following table shows the relation of our sections to that of Brainerd and Seely:

| Brainerd and Seely. | | Raymond. |
|------------------------|---|--|
| A ₁ | | A ₁₋₁₁ |
| A ₂ | = | A ₁₂₋₁₄ |
| A ₃ | = | A ₁₄₋₁₅ |
| A ₄ | = | A ₁₅₋₁₉ |
| B ₁ | = | A ₁₉₋₂₀ |
| B ₂ | = | A ₂₀₋₂₂ |
| B ₃ | = | A ₂₂₋₂₈ |
| B ₄ | = | A ₂₉ |
| B ₅ | = | A ₃₀ , D ₁₋₁₀ |
| C ₁ | = | A ₃₁₋₃₅ |
| C ₂ | = | A ₃₆₋₃₉ , C ₁₋₉ , D ₁₈₋₂₀ |
| C ₃ | = | C ₁₁ |

The accompanying diagram illustrates the relation of sections A, C, and D to each other, and the relation of all to the section made by Brainerd and Seely.

Subdivisions According to Faunules. — The study of the range of species in the Valcour Island section shows that on paleontologic grounds the strata may be divided into three divisions, each distinguished by certain characteristic species. Within certain of these

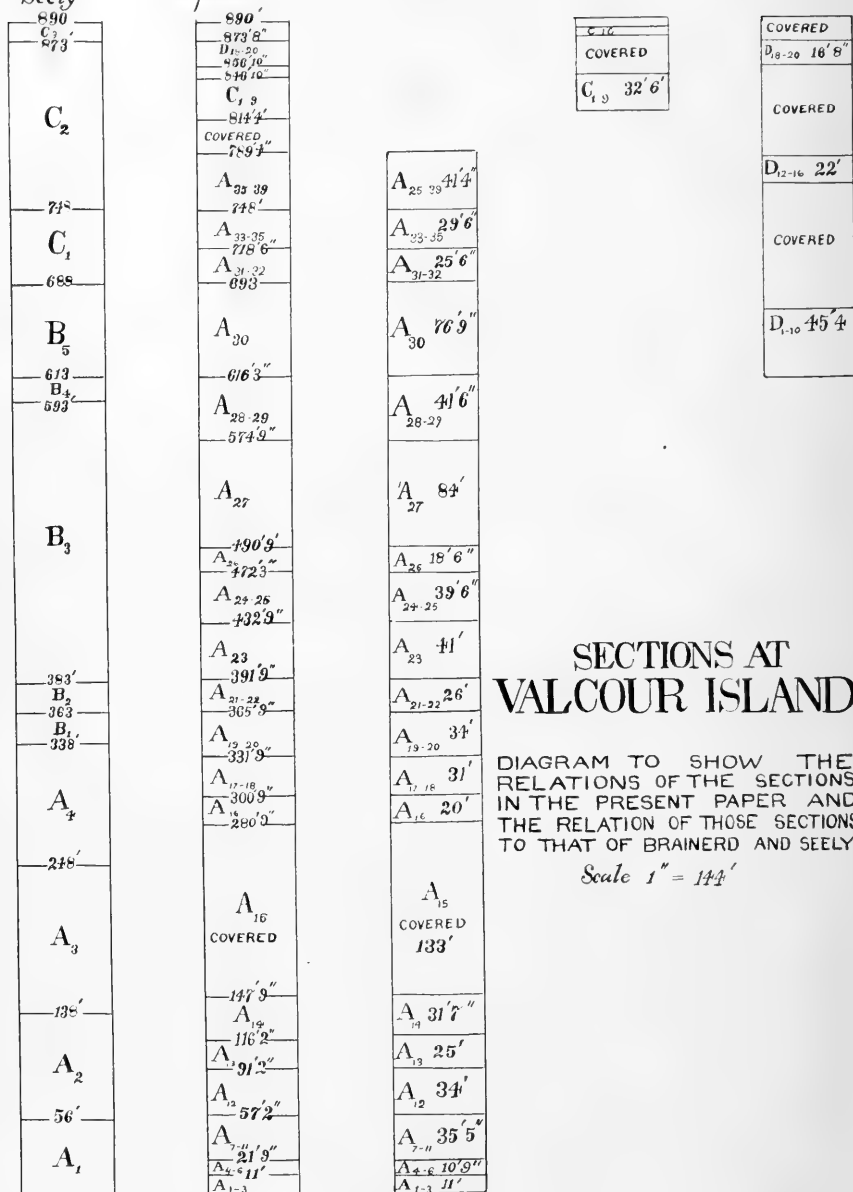
*Brainerd
and
Seely*

Composite Section

Section A

Section C

Section D

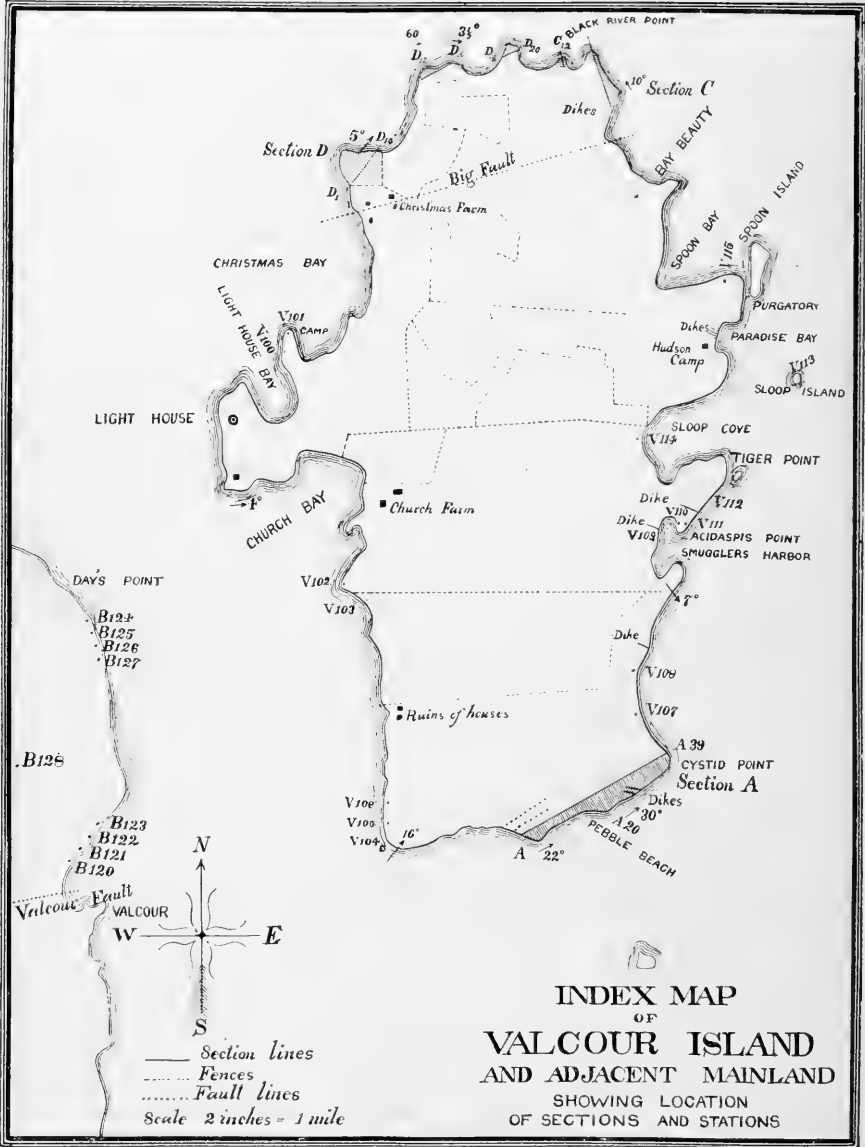


SECTIONS AT VALCOUR ISLAND

DIAGRAM TO SHOW THE
RELATIONS OF THE SECTIONS
IN THE PRESENT PAPER AND
THE RELATION OF THOSE SECTIONS
TO THAT OF BRAINERD AND SEELY

Scale 1" = 144'

FIG. 1. Diagram to show the relation of the sections on Valcour Island. In the first two sections the height of the top of each zone above the base of the section is given. In sections A, C and D, the thickness of each zone is given.



SYDNEY PRENTICE DEL.

Index map of Valcour Island, N. Y.

divisions there are definite zones, marked by their own characteristic fossils. These divisions are:

1. *The Hebertella exfoliata division.* Thickness 300 feet. A_{1-17} of the section. Characteristic fossils: *Zygospira acutirostris*, *Bolboporites americanus*, and *Hebertella exfoliata*. In spite of the fact that this division has a considerable fauna, it is separated from the divisions above chiefly by the absence of certain of the species of the higher divisions, and it has few very characteristic species of its own. At the base is a zone characterized by the abundance of *Orthis acutiplicata*.

2. *The Maclurites magnus division.* Thickness 400 feet. A_{18-32} of the section. Characteristic fossils: *Maclurites magnus*, *Rafinesquina champlainensis*, *Platymys platys*, *Camerella varians*, *Leperditia limatula* and *Strephochetus brainerdi*. A few of these species are found outside of this division, but by a *Maclurites magnus* fauna is meant the association of an abundance of these forms. This division is further marked by the great number of gastropods, as, out of sixteen forms known at Valcour Island, not less than twelve are restricted to this division. Of trilobites, *Eoharpes* and *Lonchodomas* appear here, and *Sphaerexochus* is rarely found above or below.

3. *The Camarotoechia plena division.* Thickness 175 feet. A_{33} , to top of the formation. Characteristic fossils: *Camarotoechia plena*, *Camarotoechia major*, *Orthis ignicula* and *Modiolopsis fabaformis*.

Certain of the species in the Valcour Island sections range all through the three divisions, as is shown in the accompanying table (See p. 528).

Stations on Valcour Island.

Collections have also been made at various localities on Valcour Island which are not included in any of the foregoing sections, and lists from these localities will be given under the heading of stations. These stations are indicated on the index map which accompanies this article. (Plate XXV.)

Station V_{100} . This station is on the rocks on the west side of the rocky point which separates Christmas Bay from Light House Bay. The rock exposed is a fairly coarse, dark-gray limestone, and contains *Maclurites magnus* in great abundance. The species collected are as follows:

| | |
|----------------------------------|--------------------------------|
| <i>Monotrypella</i> sp. c, | <i>Raphistoma stamineum</i> r, |
| <i>Rhynidictya fenestrata</i> c, | <i>Maclurites magnus</i> a, |

| | |
|---------------------------------------|-----------------------------------|
| Bryozoan sp. ind. r, | <i>Thaleops ovata</i> r, |
| <i>Plasiomys platys</i> c, | <i>Amphilichas minganensis</i> r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Pliomerops canadensis</i> r, |
| <i>Clitambonites multicosta</i> r, | <i>Leperditia limatula</i> r, |
| <i>Orthidium lamellosum</i> r, | <i>Leperditia canadensis</i> c. |
| <i>Camerella longirostris</i> R, | |

This fauna indicates that these strata belong to Division 2.

Station V₁₀₁. This station is at the extreme northern end of the same point. The rock is more impure, containing much clay, and *Maclurites magnus* is absent.

| | |
|---------------------------------------|------------------------------------|
| <i>Phylloporina incepta</i> r, | <i>Clitambonites multicosta</i> r, |
| <i>Hebertella</i> sp. r, | <i>Trochonema hudsoni</i> r, |
| <i>Plasiomys platys</i> r, | <i>Trochonema dispar</i> r, |
| <i>Hebertella borealis</i> r, | <i>Thaleops ovata</i> r, |
| <i>Rafinesquina alternata</i> r, | <i>Pliomerops canadensis</i> r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Amphilichas minganensis</i> r. |

This also belongs to Division 2.

Station V₁₀₂. This locality is on the first point of rock south of the lower farm-house (Church farm) at Valcour Island. The rock is a rather coarse-grained, but hard limestone, and does not yield the fossils readily.

| | |
|---------------------------------------|------------------------------------|
| <i>Monotrypella</i> sp. c, | <i>Camerella longirostris</i> c, |
| Bryozoan sp. ind. c, | <i>Asaphus alpha</i> r, |
| <i>Plasiomys platys</i> c, | <i>Asaphus beta</i> r, |
| <i>Hebertella borealis</i> c, | <i>Illicinus globosus</i> r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Pterygometopus annulatus</i> r, |
| <i>Rafinesquina distans</i> r, | <i>Leperditia canadensis</i> c. |
| <i>Camarotoechia pristinus</i> c, | |

This fauna indicates Division 2.

Station V₁₀₃. This station is on the ledges a few rods south of V₁₀₂ and near the fence between the middle and south farms. All the specimens came from a thin layer of pure limestone, in which the fossils are well preserved.

| | |
|--------------------------------|--------------------------------|
| <i>Monotrypella</i> sp. r, | <i>Conocardium beecheri</i> R, |
| <i>Phylloporina incepta</i> c, | <i>Ctenodonta peracuta</i> r, |
| Bryozoan sp. ind. c, | <i>Eoharpes antiquatus</i> r, |

| | |
|------------------------------------|---|
| <i>Rafinesquina alternata</i> r, | <i>Asaphus beta</i> r, |
| <i>Rafinesquina distans</i> r, | <i>Ilkenus globosus</i> r, |
| <i>Plesiomys platys</i> R, | <i>Thaleops ovata</i> r, |
| <i>Camerella longirostris</i> r, | <i>Sphærexochus parvus</i> c, |
| <i>Archinacella ? deformata</i> r, | <i>Pseudosphærexochus chazyensis</i> r, |
| <i>Bucania sulcatina</i> c, | <i>Amphilichas minganensis</i> r, |
| <i>Bucania catilloides</i> R, | <i>Pterygometopus annulatus</i> r, |
| <i>Trochonema hudsoni</i> c, | <i>Leperditia canadensis</i> c. |
| <i>Hormatoma</i> sp. r, | |

This fauna may belong anywhere from the upper part of Division 1 to the lower part of Division 3.

Station V₁₀₄. This station is on a small island close to the southwest point of Valcour Island. The rock is a coarse, impure limestone.

| | |
|---------------------------------------|-----------------------------|
| <i>Monotrypella</i> sp. r, | <i>Camerella varians</i> r, |
| <i>Plesiomys platys</i> r, | <i>Maclurites magnus</i> r, |
| <i>Rafinesquina champlainensis</i> r, | <i>Thaleops ovata</i> c. |

Station V₁₀₅. This station is on layers about twenty feet higher than the strata of the preceding, and is on the main island.

| | |
|--------------------------------|---------------------------------|
| <i>Malocystites</i> sp. r, | <i>Rafinesquina distans</i> c, |
| <i>Monotrypella</i> sp. r, | <i>Camerella varians</i> r, |
| Bryozoan sp. ind. r, | <i>Ilkenus globosus</i> r, |
| <i>Plesiomys platys</i> c, | <i>Thaleops ovata</i> r, |
| <i>Orthidium lamellosum</i> r, | <i>Leperditia canadensis</i> c. |

Station V₁₀₆. This station is about five rods north of the preceding one, in a ledge at the water's edge.

| | |
|---------------------------------------|----------------------------------|
| <i>Malocystites</i> sp. c, | <i>Rafinesquina alternata</i> r, |
| <i>Phylloporina incepta</i> c, | <i>Camerella longirostris</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Hormatoma</i> sp. r, |
| <i>Orthis ignicula</i> r, | <i>Isotelus harrisi</i> r, |
| <i>Plesiomys platys</i> c, | <i>Thaleops ovata</i> . |
| <i>Rafinesquina champlainensis</i> c, | |

The rocks of stations V₁₀₄-V₁₀₆ all belong to Division 2.

Station V₁₀₇. The next station is on the east side of Valcour Island on the rocky shore which extends from Cystid Point to the point on the south side of Smuggler's Bay. The position of these layers in the section is not known exactly, but they probably come in just below



G. H. HUDSON, PHOTO.

Smugglers Bay and Tiger Point, Valcour Island.

the layers on Cystid Point. The rock is a coarse, gray, crinoidal limestone in rather heavy beds.

| | |
|----------------------------------|-------------------------------------|
| <i>Malocystites</i> sp. r, | <i>Camarotoechia plena</i> c, |
| Coral sp. ind. c, | <i>Raphistoma striatum</i> c, |
| <i>Monotrypella</i> sp. a, | <i>Isotelus obtusum</i> a, |
| <i>Rhinidictya fenestrata</i> c, | <i>Isotelus harrisi</i> r, |
| <i>Phylloporina incepta</i> c, | <i>Thaleops ovata</i> r, |
| <i>Hebertella</i> sp. r, | <i>Leperditia canadensis</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Eurychilina latimarginata</i> r. |
| <i>Rafinesquina alternata</i> r, | |

Station V₁₀₅. This station is in a similar limestone about twenty feet higher than the preceding.

| | |
|----------------------------------|---------------------------------|
| <i>Monotrypella</i> sp. c, | <i>Camarotoechia plena</i> a, |
| <i>Rhinidictya fenestrata</i> c, | <i>Bucania sulcatina</i> c, |
| <i>Hebertella vulgaris</i> c, | <i>Isotelus obtusum</i> r, |
| <i>Rafinesquina alternata</i> r, | <i>Leperditia canadensis</i> c. |

Both of the preceding belong to Division 3.

Station V₁₀₉. This station is on the ledge midway between the two arms of Smuggler's Bay. The rock is a fine-grained buff dolomite showing reef structure.

| | |
|-------------------------------------|-------------------------------------|
| <i>Stylaræa parva</i> c, | <i>Illænus globosus</i> r, |
| <i>Platymys platys</i> r, | <i>Illænus crastusi</i> c, |
| <i>Strophomena prisca</i> r, | <i>Amphilichas minganensis</i> r, |
| <i>Rafinesquina incrassata</i> r, | <i>Glaphurus pustulatus</i> c, |
| <i>Clionychia montrealensis</i> r, | <i>Pliomerops canadensis</i> c, |
| <i>Ctenodonta peracuta</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Bucania sulcatina</i> c, | <i>Eurychilina latimarginata</i> r. |
| <i>Orthoceras</i> , 2 or 3 species, | |

Station V₁₁₀. This station is in the buff dolomite of the reef on the point, which extends into Smuggler's Bay from the north. The lithologic characters are the same as at the preceding locality. See Plate XXIII.

| | |
|------------------------------|-------------------------------|
| <i>Stylaræa parva</i> c, | <i>Cyrtoceras</i> sp. ind. r, |
| <i>Stromatocerium</i> sp. c, | <i>Eoharpes antiquatus</i> R, |
| <i>Lingula columba</i> r, | <i>Isotelus harrisi</i> c, |
| <i>Hebertella</i> sp. c, | <i>Isotelus obtusum</i> r, |

| | |
|-------------------------------------|---------------------------------------|
| <i>Hebertella vulgaris</i> c, | <i>Asaphus marginalis</i> R, |
| <i>Platysomys platys</i> r, | <i>Illænus globosus</i> c, |
| <i>Rafinesquina incrassata</i> c, | <i>Illænus indeterminatus</i> R, |
| <i>Rafinesquina distans</i> r, | <i>Illænus erastusi</i> c, |
| <i>Orthidium lamellosum</i> r, | <i>Plomerops canadensis</i> c, |
| <i>Camerella varians</i> R, | <i>Pseudosphærexochus vulcanus</i> R, |
| <i>Camarotoechia plena</i> r, | <i>Sphærexochus parvus</i> c, |
| <i>Conularia triangularis</i> r, | <i>Glaphurus pustulatus</i> c, |
| <i>Orthoceras</i> , 3 or 4 species, | <i>Remopleurides canadensis</i> c. |
| <i>Plectoceras jason</i> r, | |

Station V₁₁₁. On the same point as the preceding is a coarse-grained, blue-gray limestone which was evidently deposited outside the reef formed by the *Stromatocerium*. The fauna in this material differs slightly from that in the pure dolomite. It is given below :

| | |
|------------------------------------|-----------------------------------|
| <i>Malocystites emmonsii</i> c, | <i>Ambonychia curvata</i> c, |
| <i>Rhinidictya fenestrata</i> c, | <i>Bucania sulcatina</i> c, |
| <i>Phylloporina incepta</i> c, | <i>Illænus erastusi</i> , |
| <i>Lingula columba</i> r, | <i>Illænus globosus</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Thaleops ovata</i> r, |
| <i>Rafinesquina incrassata</i> c, | <i>Amphilichas minganensis</i> r, |
| <i>Camerella longirostris</i> r, | <i>Sphærexochus parvus</i> R, |
| <i>Camerella varians</i> r, | <i>Leperditia canadensis</i> c. |
| <i>Clionychia montrealensis</i> r, | |

V₁₀₉—V₁₁₁ all belong to Division 3.

Station V₁₁₂. The layers along the south shore of Tiger Point form Station V₁₁₂. These strata are a dark-gray, impure limestone and underlie the reef material of V₁₁₀. At this station good entire specimens of *Plomerops canadensis* may be obtained, and specimens of *Bucania sulcatina* are especially abundant. See Plate XXIII.

| | |
|----------------------------------|-----------------------------------|
| <i>Malocystites emmonsii</i> c, | <i>Rafinesquina incrassata</i> c, |
| <i>Malocystites</i> sp. r, | <i>Platysomys platys</i> c, |
| <i>Eospongia varians</i> c, | <i>Bucania sulcatina</i> c, |
| <i>Monotrypella</i> sp. c, | <i>Illænus globosus</i> r, |
| <i>Rhinidictya fenestrata</i> c, | <i>Amphilichas minganensis</i> r, |
| <i>Lingula columba</i> r, | <i>Plomerops canadensis</i> c. |

Station V₁₁₃. On Sloop Island, a rocky islet half a mile east of Valcour Island, the buff dolomite of the reef is well shown, and is under-

laid, as at the point in Smuggler's Bay, by a coarse-grained, blue limestone. This blue limestone is very fossiliferous on Sloop Island, while the reef material is only sparingly so. The reef material contains :

| | |
|------------------------------|-------------------------------|
| <i>Stromatocerium</i> sp. c, | <i>Hebertella vulgaris</i> r, |
| <i>Fletcheria incerta</i> c, | <i>Ambonychia curvata</i> R. |

The blue limestone contains :

| | |
|-----------------------------------|--------------------------------------|
| <i>Rhinidictya fenestrata</i> c, | <i>Orthoceras</i> sp. r, |
| <i>Phylloporina incepta</i> c, | <i>Isotelus harrisi</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Illæus globosus</i> c, |
| <i>Stenopora patula</i> c, | <i>Thaleops ovata</i> r, |
| <i>Crania prona</i> r, | <i>Ceraurus pompilius</i> R, |
| <i>Hebertella vulgaris</i> c, | <i>Sphærocoryphe goodnowi</i> R, |
| <i>Rafinesquina incrassata</i> c, | <i>Pliomerops canadensis</i> r, |
| <i>Camerella varians</i> c, | <i>Sphærexochus parvus</i> c, |
| <i>Orthidium lamellosum</i> r, | <i>Pseudosphærexochus satyrus</i> R, |
| <i>Ambonychia curvata</i> c, | <i>Amphilichas minganensis</i> r, |
| <i>Conocardium beecheri</i> c, | <i>Glaphurus pustulatus</i> r, |
| <i>Hormotoma</i> sp. r, | <i>Leperditia canadensis</i> . |
| <i>Bucania sulcatina</i> c, | |

V₁₁₃ belongs to Division 3.

Station V₁₁₄. The next station is on the ledge in the middle of the shore of Sloop Bay, often mentioned in this article as the "Trilobite layers at Sloop Bay." These layers are a heavy-bedded, pure black limestone, and carry an abundant fauna.

| | |
|---------------------------------------|------------------------------------|
| <i>Malocystites</i> sp. ind. R, | <i>Raphistoma stamineum</i> r, |
| <i>Monotrypella</i> sp. r, | <i>Trochonema dispar</i> r, |
| <i>Lingula</i> sp. ind. r, | <i>Lophospira perangulata</i> r, |
| <i>Plæsiomys platys</i> c, | <i>Lophospira subabbreviata</i> c, |
| <i>Plæsiomys strophomenoides</i> r, | <i>Bucania sulcatina</i> R, |
| <i>Rafinesquina champlainensis</i> c, | <i>Subulites prolongata</i> R, |
| <i>Rafinesquina alternata</i> r, | <i>Eoharpes ottawaënsis</i> R, |
| <i>Camerella varians</i> r, | <i>Lonchodomas halli</i> c, |
| <i>Camerella longirostris</i> r, | <i>Bathyuirellus minor</i> c, |
| <i>Ctenodonta peracuta</i> c, | <i>Asaphus marginalis</i> c, |
| <i>Ctenodonta dubiaformis</i> r, | <i>Isotelus harrisi</i> R, |
| <i>Ctenodonta ? bidorsata</i> r, | <i>Isotelus obtusus</i> c, |

| | |
|---|---|
| <i>Vanuxemia limbata</i> r, | <i>Isotelus</i> ? <i>bearsi</i> c, |
| <i>Clionychia marginalis</i> ? r, | <i>Thaleops ovata</i> c, |
| <i>Ambonychia curvata</i> c, | <i>Remopleurides canadensis</i> r, |
| <i>Cyrtodonta scala</i> R, | <i>Ceraurus pompilius</i> c, |
| <i>Whiteavesia</i> ? <i>expansa</i> R, | <i>Ceraurus hudsoni</i> c, |
| <i>Endodesma tranceps</i> c, | <i>Pliomerops canadensis</i> R, |
| <i>Clidophorus obscurus</i> r, | <i>Pseudosphærexochus vulcanus bil-</i> |
| <i>Endodesma undatum</i> R, | <i>lingsi</i> r, |
| <i>Archinacella</i> ? <i>deformata</i> c, | <i>Pseudosphærexochus approximatus</i> R, |
| <i>Hormotoma infrequens</i> ? r, | <i>Amphilichas minganensis</i> r, |
| <i>Hormotoma</i> sp., | <i>Pterygometopus annulatus</i> c, |
| <i>Eccyliopterus kalmi</i> R, | <i>Leperditia limatula</i> c, |
| <i>Holopea plautus</i> ? r, | <i>Leperditia canadensis</i> c, |
| <i>Holopea scrutator</i> r, | <i>Isochilina labrosa</i> ? r, |
| <i>Trochonema hudsoni</i> c, | <i>Eurychilina latimarginata</i> r, |
| <i>Raphistomina undulata</i> r, | <i>Schmidtella crassimarginata</i> r. |

This fauna indicates Division 2.

Station V₁₁₅. This station is on the south shore of Spoon Bay, near the entrance to "Purgatory." The strata are rather heavy bedded, blue-black limestones, and the fossils are silicified.

| | |
|---------------------------------------|------------------------------------|
| <i>Strephochetus</i> sp. c, | <i>Bucania sulcatina</i> c, |
| <i>Eospongia varians</i> r, | <i>Eccyliopterus fredericus</i> r, |
| <i>Malocystites murchisoni</i> r, | <i>Orthoceras</i> sp. r, |
| <i>Malocystites</i> sp. r, | <i>Eoharpes antiquatus</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Lonchodomas halli</i> r, |
| <i>Hebertella</i> sp. c, | <i>Sphærexochus parvus</i> c, |
| <i>Platysomys strophomenoides</i> r, | <i>Isotelus harrisi</i> c, |
| <i>Rafinesquina champlainensis</i> c, | <i>Cybele prima</i> R, |
| <i>Maclurites magnus</i> c, | <i>Pterygometopus annulatus</i> c. |
| <i>Lophospira subabbreviata</i> r, | |

This fauna belongs in Division 2. Both the species found and the lithologic characters of these layers indicate about the same horizon as A 21 of the section on the south end of the island.

Stations at Valcour, New York.

These stations are along the lake shore at Valcour, just west of Valcour Island, and about a mile distant.

Station B₁₂₀. These are the lowest layers exposed north of the fault between the Beekmantown and Chazy. The locality is just across the bay north of Sibley's dock.

| | |
|--|-------------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Plectoceras jason</i> r, |
| <i>Rhinidictya fenestrata</i> r, | <i>Eoharpes antiquatus</i> c, |
| <i>Phylloporina incepta</i> c, | <i>Eoharpes ottawaënsis</i> r, |
| <i>Rafinesquina alternata</i> r, | <i>Lonchodomas halli</i> c, |
| <i>Hebertella vulgaris</i> r, | <i>Isotelus harrisi</i> , c, |
| <i>Plæsiomys platys</i> c, | <i>Illænus globosus</i> c, |
| <i>Camerella varians</i> c, | <i>Ceraurus pompilius</i> r, |
| <i>Camerella longirostris</i> r, | <i>Sphærexochus parvus</i> r, |
| <i>Camarotoechia pristina</i> c, | <i>Cybele prima</i> r, |
| <i>Ctenodonta dubiaformis</i> r, | <i>Pterygometopus annulatus</i> R, |
| <i>Archinacella?</i> <i>deformata</i> r, | <i>Leperditia canadensis</i> r, |
| <i>Orthoceras</i> sp. ind. r, | <i>Eurychilina latimarginata</i> r. |

Station B₁₂₁. A layer about six feet above the preceding.

| | |
|-----------------------------------|---------------------------------|
| <i>Malocystites</i> sp. ind. c, | <i>Lophospira</i> sp. ind., |
| <i>Bolboporites americanus</i> c, | <i>Raphistoma stamineum</i> r, |
| <i>Rhinidictya fenestrata</i> r, | <i>Eoharpes antiquatus</i> c, |
| <i>Plæsiomys platys</i> c, | <i>Asaphus alpha</i> R, |
| <i>Hebertella vulgaris</i> c, | <i>Isotelus obtusus</i> c, |
| <i>Camerella varians</i> c, | <i>Illænus globosus</i> c, |
| <i>Ambonychia curvata</i> r, | <i>Thaleops ovata</i> c, |
| <i>Bucania bidorsata?</i> r, | <i>Pliomerops canadensis</i> c. |

Station B₁₂₂. About four feet above B₁₂₁.

| | |
|----------------------------------|------------------------------------|
| <i>Malocystites</i> sp. ind. c, | <i>Zygospira acutirostris</i> c, |
| <i>Monotrypella</i> sp. r, | <i>Clionychia montrealensis</i> r, |
| <i>Plæsiomys platys</i> c, | <i>Trochonema hudsoni</i> r, |
| <i>Rafinesquina alternata</i> c, | <i>Eoharpes antiquatus</i> c, |
| <i>Camerella varians</i> c, | <i>Thaleops ovata</i> r. |

Station B₁₂₃. About ten feet above the preceding.

| | |
|-------------------------------|----------------------------------|
| <i>Hebertella vulgaris</i> r, | <i>Camerella longirostris</i> c, |
| <i>Plæsiomys platys</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Camerella varians</i> c, | <i>Thaleops ovata</i> r. |

Station B₁₂₄. This station is at about lake level on the shore at Day's Point, half a mile north of the preceding stations.

| | |
|-----------------------------|---------------------------------|
| <i>Monotrypella</i> sp. c, | <i>Isotelus harrisi</i> c, |
| <i>Plæsiomys platys</i> c, | <i>Isotelus obtusus</i> c, |
| <i>Camerella varians</i> r, | <i>Thaleops ovata</i> c, |
| <i>Orthoceras</i> sp. c, | <i>Pliomerops canadensis</i> r. |
| <i>Plectoceras jason</i> c, | |

Station B₁₂₅. A layer about five feet above B₁₂₄.

| | |
|----------------------------------|---|
| <i>Malocystites</i> sp. ind. r, | <i>Clionychia montrealensis</i> r, |
| Coral sp. ind. r, | <i>Archinacella</i> ? <i>deformata</i> r, |
| <i>Phylloporina incepta</i> r, | <i>Scenella robusta</i> r, |
| <i>Rhinidictya fenestrata</i> c, | <i>Raphistoma stamineum</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Eoharpes antiquatus</i> c, |
| <i>Lingula columba</i> r, | <i>Isotelus obtusus</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Thaleops ovata</i> c, |
| <i>Plæsiomys platys</i> c, | <i>Sphærexochus parvus</i> r, |
| <i>Rafinesquina alternata</i> c, | <i>Pseudosphærexochus</i> sp. r, |
| <i>Camerella varians</i> c, | <i>Pterygometopus annulatus</i> r, |
| <i>Camerella longirostris</i> c, | <i>Leperditia canadensis</i> c. |

Station B₁₂₆. About fifteen feet above B₁₂₅.

| | |
|---------------------------------------|--|
| <i>Malocystites</i> sp. ind. r, | <i>Archinacella</i> ? <i>proprius</i> r, |
| <i>Paleocystites tenuiradiatus</i> r, | <i>Eoharpes antiquatus</i> r, |
| <i>Rhinidictya fenestrata</i> r, | <i>Lonchodomas halli</i> c, |
| <i>Monotrypella</i> sp. c, | <i>Isotelus obtusus</i> R, |
| <i>Plæsiomys platys</i> c, | <i>Illænus globosus</i> c, |
| <i>Hebertella vulgaris</i> c, | <i>Sphærexochus parvus</i> r, |
| <i>Rafinesquina distans</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Zygospira acutirostris</i> c, | <i>Eurychilina latimarginata</i> r. |
| <i>Ctenodonta dubiaformis</i> r, | |

Station B₁₂₇. Seven feet above B₁₂₆.

| | |
|-----------------------------------|----------------------------------|
| <i>Malocystites</i> sp. ind. c, | <i>Camerella longirostris</i> R, |
| <i>Monotrypella</i> sp. c, | <i>Zygospira acutirostris</i> r, |
| <i>Rhinidictya fenestrata</i> c, | <i>Ctenodonta</i> sp. R, |
| <i>Phylloporina incepta</i> r, | <i>Bucania sulcatina</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Eoharpes antiquatus</i> R, |
| <i>Plæsiomys platys</i> r, | <i>Leperditia canadensis</i> c. |
| <i>Rafinesquina incrassata</i> c, | |

Station B₁₂₈. This station includes all the strata exposed in the large quarries near the road between Valcour and Day's Point. This locality has furnished many fine specimens, and is the type locality for *Cybele primus*.

| | |
|---|-------------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Raphistoma stamineum</i> c, |
| <i>Malocystites emmonsii</i> c, | <i>Conularia triangularis</i> r, |
| <i>Malocystites murchisoni</i> R, | <i>Orthoceras</i> sp. ind. r, |
| <i>Glyptocystites forbesi</i> c, | <i>Plectoceras jason</i> c, |
| <i>Bolboporites americanus</i> c, | <i>Eoharpes antiquatus</i> c, |
| <i>Bolboporites</i> sp. a, | <i>Lonchodomas halli</i> c, |
| <i>Rhinidictya fenestrata</i> r, | <i>Asaphus alpha</i> c, |
| <i>Monotrypella</i> sp. r, | <i>Isotelus obtusus</i> c, |
| <i>Lingula columba</i> r, | <i>Illænus erastusi</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Illænus globosus</i> c, |
| <i>Rafinesquina incrassata</i> r, | <i>Thaleops ovata</i> c, |
| <i>Camerella varians</i> c, | <i>Pliomerops canadensis</i> r, |
| <i>Camerella longirostris</i> r, | <i>Cybele prima</i> r, |
| <i>Zygospira acutirostris</i> c, | <i>Lepeditia canadensis</i> c, |
| <i>Archinacella?</i> <i>proprius</i> r, | <i>Eurychilina latimarginata</i> c. |
| <i>Lophospira subabbreviata</i> r, | |

Station at Plattsburgh, New York.

Station P₁₃₀. In a field a quarter of a mile north of the Normal School at Plattsburgh, New York, is an excellent exposure of the *Scalites* beds.

| | |
|----------------------------------|-------------------------------------|
| <i>Malocystites</i> sp. r, | <i>Scalites angulatus</i> c, |
| <i>Hebertella exfoliata</i> r, | <i>Eunema historicum</i> r, |
| <i>Camerella longirostris</i> c, | <i>Illænus globosus</i> c, |
| <i>Zygospira acutirostris</i> c, | <i>Thaleops ovata</i> r, |
| <i>Bucania sulcatina</i> c, | <i>Lepeditia canadensis</i> c, |
| <i>Raphistoma immaturum</i> c, | <i>Eurychilina latimarginata</i> r. |
| <i>Raphistoma stamineum</i> c, | |

Sections at Chazy, New York.

The section at Chazy, New York, has been described in considerable detail by Brainerd and Seely, but they gave only a very small list of fossils. In the summer of 1902 the writer made detailed sections over the ground described by Brainerd and Seely, and collected fossils

from each zone. These fossils appear to have been lost while en route to the Cornell University Museum, and opportunity to repeat this work has not presented itself. A collection made for the Yale University Museum in the summer of 1903 has supplied lists from certain of the layers. These with notes made in 1902 and 1904 will serve to indicate fairly well the nature of the fauna in the lower and middle portion of the formation at Chazy.

Section D, Chazy, New York.

This section begins where Tracy Brook crosses the road about a mile southwest of Chazy village.

D₁. Compact, coarsely crystalline, light-gray limestone which has a yellow, sandy appearance on the weathered surface. Very fossiliferous, the brachiopods being most abundant. *Hebertella exfoliata* is common.

These are the lowest layers at Chazy. About one eighth of a mile west, beside the Delaware and Hudson railroad track, the Potsdam sandstone, lying almost horizontally, is exposed. The Chazy strata dip away from the Potsdam at an angle of ten to twenty degrees.

17 feet = 17 feet.

D₂. Hard, fine-grained, dark-blue magnesian limestone, with trilobites at the base. Species of *Isotelus* and *Illænus*, and many brachiopods, occur near the top.

16 feet 3 inches = 33 feet 3 inches.

D₃. Lithologically about the same as the preceding, but the weathered surfaces show many fucoidal markings.

19 feet 9 inches = 53 feet.

D₄. Light-gray, fine-grained dolomitic limestone with narrow but conspicuous yellow streaks on the weathered surface. No fossils.

27 feet = 80 feet.

D₅. Like the preceding, but with fewer yellow streaks and some fossils.

9 feet 6 inches = 89 feet 6 inches.

D₆. Concealed.

10 feet = 99 feet 6 inches.

Top of A₁, Brainerd and Seely's section.

D₇. Fine-grained, fairly pure dolomite, with the weathered surface covered with cystid fragments. A₂ of Brainerd and Seely's section.

20 feet = 119 feet 6 inches.

D₈. Concealed across a narrow trough in which there is an almost stagnant stream.

40 feet = 159 feet 6 inches.

D₉. Light-gray, thin-bedded, very fossiliferous dolomitic limestone. Best exposed at the end of the ridge near the road.

21 feet = 180 feet 6 inches.

D₁₀. Very much like the preceding, but containing great numbers of cystid fragments and many bryozoa. 9 feet = 189 feet 6 inches.

D₁₁. Concealed. 10 feet = 199 feet 6 inches.

D₁₂. Compact, fine-grained limestone with few fossils. *Scalites angulatus* occurs in the top layer only. 17 feet 6 inches = 217 feet.

Hebertella exfoliata c,

Scalites angulatus r,

Camerella varians r,

Thaleops ovata r,

Camerella longirostris r,

Leperditia canadensis c,

Raphistoma stamineum c,

Eurychilina latimarginata r.

Bucania sulcatina r,

D₁₃. Light-gray, coarse-grained, heavy-bedded limestone with numerous fossils.

10 feet = 227 feet.

Monotrypella sp. r,

Isotelus harrisi r,

Phylloporina incepta r,

Illænus globosus c,

Orthis acutiplicata ? r,

Thaleops ovata r,

Hebertella exfoliata c,

Leperditia canadensis c.

Hebertella vulgaris c,

D₁₄. Covered. 30 feet = 257 feet.

D₁₅. Two beds of reddish, coarse-grained crystalline limestone. No fossils except *Leperditia canadensis*. 3 feet = 260 feet.

D₁₆. Covered. 10 feet = 270 feet.

D₁₇. Reddish, rather crystalline limestone full of fragments of trilobites, principally *Illænus*. 10 feet = 280 feet.

On this section line, which follows the direction of Section I of Brainerd and Seely's map, the strata are not well exposed above D₁₃ of the present section, which equals A₆ of Brainerd and Seely's section. Twenty rods east of D₁₇ the *Maclurites* layers are encountered, but the layers are not well exposed and collecting is difficult. One hundred and twenty rods southeast of the good outcrop at D₁₃ is a low ledge of very hard, dull-gray dolomite, from which the fossils can not be extracted except by roasting the matrix. In this layer, *Lophospira subabbreviata*, *Lophospira perangulata*, and a long slender species of *Homotoma* are rather abundant. This is the same layer which is encountered in section F (F₈₋₁₁), and is the C₁₋₇ of Brainerd and Seely's section.

Twenty rods east of this outcrop, and between it and the West Chazy road, are exposed thin shaly layers with *Camarotoechia plena* and *Hebertella vulgaris* in abundance. Twenty-five rods east of this, at the corner of the field near the road, the massive black limestone of the Black River is encountered. As the dip and strike seem to remain the same throughout this section it is a good place to measure the thickness of the formation at Chazy, but the fossils are better obtained in other sections.

Section E, Chazy, New York.

This is Brainerd and Seely's section II, and all that the present writer wishes to do is to give the faunules in the zones described by those writers.

$E_5 = A_5$, Brainerd and Seely. Fine-grained massive limestone.

25 feet = 25 feet.

| | |
|----------------------------------|------------------------------------|
| <i>Camerella varians</i> r, | <i>Orthoceras</i> sp. r, |
| <i>Raphistoma stamineum</i> c, | <i>Remopleurides canadensis</i> R, |
| <i>Raphistoma immaturum</i> r, | <i>Isotelus harrisi</i> r, |
| <i>Lophospira perangulata</i> r, | <i>Illænus globosus</i> r, |
| <i>Bucania sulcatina</i> c, | <i>Thaleops ovata</i> r, |
| <i>Scalites angulatus</i> c, | <i>Eurychilina canadensis</i> R. |

$E_6 = A_6$, B. and S. Covered. 10 feet = 35 feet.

$E_7 = A_7$, B. and S. Covered. 25 feet = 60 feet.

$E_8 = A_8$, B. and S. Massive gray limestone, largely made up of crinoidal remains. 50 feet = 110 feet.

| | |
|-----------------------------------|-------------------------------------|
| <i>Malocystites murchisoni</i> r, | <i>Lophospira subabbreviata</i> c, |
| <i>Bolboporites americanus</i> r, | <i>Raphistoma stamineum</i> c, |
| <i>Monotrypella</i> sp. r, | <i>Eoharpes antiquatus</i> c, |
| <i>Hebertella vulgaris</i> c, | <i>Bathyrellus brevispinus</i> R, |
| <i>Camerella varians</i> r, | <i>Isotelus harrisi</i> r, |
| <i>Archinacella ? propria</i> c, | <i>Isotelus</i> sp. ind. r, |
| <i>Palæacmæa irregularis</i> c, | <i>Illænus globosus</i> c, |
| <i>Bucania sulcatina</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Holopea</i> sp. r, | <i>Eurychilina latimarginata</i> c. |

This zone is well exposed again south of Kilns 6 and 7 of the Chazy Marble Lime Company, near the spur running to their lower quarry. The fauna at this locality, Station M₁₃₁, is as follows:

| | |
|----------------------------------|------------------------------------|
| <i>Camerella longirostris</i> r, | <i>Eunema leptonotum</i> R, |
| <i>Zygospira acutirostris</i> R, | <i>Lophospira subabbreviata</i> c, |
| <i>Scenella montrealensis</i> c, | <i>Maclurites magnus</i> r, |
| <i>Scenella pretensa</i> r, | <i>Illænus globosus</i> r, |
| <i>Bucania sulcatina</i> r, | <i>Leperditia canadensis</i> r. |
| <i>Raphistoma stamineum</i> c, | |

Station M₁₃₂. These same layers are again exposed west of the ridge where *Scalites angulatus* occurs. The fauna here is :

| | |
|---|---|
| <i>Blastoidocrinus expansa</i> ²⁶ c, | <i>Scenella montrealensis</i> c, |
| <i>Malocystites</i> sp. ind. c, | <i>Palæacmæa irregularis</i> c, |
| <i>Paleocystites tenuiradiatus</i> c, | <i>Raphistoma stamineum</i> a, |
| <i>Bolboporites americanus</i> c, | <i>Raphistoma striatum</i> r, |
| <i>Rhinidictya fenestrata</i> c, | <i>Helicotoma</i> sp. ind. R, |
| <i>Phylloporina incepta</i> c, | <i>Lophospira</i> sp. ind. R, |
| <i>Monotrypella</i> sp. r, | <i>Lophospira subabbreviata</i> c, |
| <i>Lingula belli</i> r, | <i>Eoharpes antiquatus</i> r, |
| <i>Crania prona</i> r, | <i>Asaphus beta</i> c, |
| <i>Schizambon ? duplicimuratus</i> r, | <i>Illænus globosus</i> c, |
| <i>Hebertella exfoliata</i> r, | <i>Illænus erastusi</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Amphilichas minganensis</i> R, |
| <i>Camerella varians</i> r, | <i>Pseudosphærexochus chazyensis</i> r, |
| <i>Zygospira acutirostris</i> r, | <i>Heliomera sol</i> R, |
| <i>Clionychia marginalis</i> r, | <i>Sphærexochus partus</i> r, |
| <i>Cyrtodonta solitaria</i> R, | <i>Leperditia canadensis</i> c, |
| <i>Archinacella propria</i> r, | <i>Eurychilina latimarginata</i> r. |

²⁶ *Streptelasma expansa* Hall, was founded upon a plate of a *Blastoidocrinus* from this locality. As there appear to be plates of two species of this genus in the Chazy limestone it is probable that Billings' specific name *carchariædens* can be retained for one species, but Hall's name must be adopted for this one at Chazy. *Streptelasma expansa* was the first species described by Professor Hall under his generic diagnosis of *Streptelasma*, but was not designated by him at the time as the type of the genus, which is fortunate, for if it had been, the genus would have been invalid. Milne Edwards and Haime, and others whose work followed closely upon that of Hall considered *Streptelasma corniculum* to be the type of the genus, and this species was definitely selected as the type by Roemer in 1861, and others. The species *Streptelasma corniculum* once being selected as the type of the genus, the later references by Hall, 1886, Scherzer, 1891, Girty, 1894, Winchell and Schuchert, 1895, and Lambe, 1901, to *Streptelasma expansa* as the type of the genus cannot be considered as having any effect. In another paper the writer will deal with this subject more fully.

$E_9 = B_1$, Brainerd and Seely. Thick-bedded, nodular, dark-colored limestone. 50 feet = 160 feet.

$E_{10} = B_2$, Brainerd and Seely, massive, pure limestone, fine-grained, often oölitic. 20 feet = 180 feet.

In the upper part of this zone there are lenses of pure limestone which furnish a very fine collection of fossils. These beds are exposed in Mr. R. S. McCullough's sugar bush. This is the type locality for *Sphaerocoryphe goodnovi*.

| | |
|----------------------------------|-----------------------------------|
| <i>Rhinidictya fenestrata</i> c, | <i>Eoharpes antiquatus</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Lonchodomas halli</i> r, |
| <i>Camerella longirostris</i> r, | <i>Asaphus beta</i> r, |
| <i>Camarotæchia pristina</i> c, | <i>Asaphus marginalis</i> R, |
| <i>Zygospira acutirostris</i> c, | <i>Isotelus harrisi</i> R, |
| <i>Cônocardium beecheri</i> R, | <i>Illænus globosus</i> a, |
| <i>Bucania sulcatina</i> r, | <i>Thaleops ovata</i> r, |
| <i>Eunema</i> sp. R, | <i>Sphaerocoryphe goodnovi</i> c, |
| <i>Raphistoma stamineum</i> r, | <i>Sphærexochus parvus</i> c, |
| <i>Cyrtospira raymondi</i> R, | <i>Amphilichas minganensis</i> r, |
| <i>Trochonema hudsoni</i> r, | <i>Leperditia canadensis</i> r. |

$E_{11} = B_3$, Brainerd and Seely. Massive, bluish-black, tolerably pure nodular limestone, containing *Maclurites magnus* and masses of black chert. Fossils few. 45 feet = 225 feet.

| | |
|---------------------------------------|---------------------------------|
| <i>Rhinidictya fenestrata</i> c, | <i>Camarotæchia pristina</i> r, |
| <i>Plæsiomys platys</i> r, | <i>Maclurites magnus</i> c, |
| <i>Rafinesquina champlainensis</i> r, | <i>Illænus globosus</i> r, |
| <i>Camerella longirostris</i> r, | <i>Pliomerops canadensis</i> r. |
| <i>Zygospira acutirostris</i> c, | |

$E_{12} = B_4$, Brainerd and Seely. Similar to the preceding. 90 feet = 315 feet.

Only about twenty feet of rock are actually exposed in this zone. The fauna here is:

| | |
|-----------------------------------|--------------------------------------|
| <i>Eospongia varians</i> c, | <i>Maclurites magnus</i> c, |
| <i>Stromatocerium</i> sp. c, | <i>Cyrtospira raymondi</i> R, |
| <i>Monotrypella</i> sp. c, | <i>Trochonema rectangularis</i> R, |
| <i>Orthidium lamellosum</i> r, | <i>Orthoceras</i> , several species, |
| <i>Camerella longirostris</i> r, | <i>Cyrtoceras</i> , 2 species, |
| <i>Rafinesquina incrassata</i> r, | <i>Amphilichas minganensis</i> R, |

| | |
|---------------------------------------|---------------------------------|
| <i>Rafinesquina champlainensis</i> r, | <i>Illænus globosus</i> c, |
| <i>Zygospira acutirostris</i> c, | <i>Glaphurus pustulatus</i> R, |
| <i>Holopea</i> sp. ind. r, | <i>Pliomerope canadensis</i> r, |
| <i>Bucania sulcatina</i> r, | <i>Leperditia canadensis</i> c. |

Beyond this outcrop there is very little rock exposed until the Black River limestone is reached. The two outcrops which do occur are the layers B₅ and C₁₋₇ of Brainerd and Seely's section.

Section F, Chazy, New York.

This section begins at Kilns 6 and 7 of the Chazy Marble Lime Company, and extends east to the Black River limestone in R. S. McCullough's dooryard. It is about the line of Brainerd and Seely's section III.

F₁. Heavy-bedded, rather pure, fine-grained, dark-blue limestone, which on the weathered surface is covered with a coarse network of yellowish protruding lines, giving the rock the general appearance of the fucoïdal layers of the Beekmantown formation. The weathered surface shows fragments of many fossils, but very few are obtained on breaking the rock.

13 feet 9 inches = 13 feet 9 inches.

| | |
|---------------------------------------|---------------------------------------|
| <i>Rhinidictya fenestrata</i> c, | <i>Plæsiomys platys</i> r, |
| <i>Monotrypella</i> sp. c, | <i>Rafinesquina champlainensis</i> r, |
| <i>Paleocystites tenuiradiatus</i> c, | <i>Isotelus</i> sp. r, |
| <i>Strephochetus</i> sp. c, | <i>Maclurites magnus</i> r. |

F₂. Two heavy beds of limestone similar to the preceding, but without the yellow streaks on the weathered surface. These layers are full of sponge-like forms, which show very distinctly on the weathered surface and give the layers a mottled appearance. The fossils show on the surface, but are difficult to extract.

8 feet 6 inches = 22 feet 3 inches.

| | |
|---------------------------------------|-----------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Orthoceras</i> sp. c, |
| <i>Strephochetus</i> sp. a, | <i>Cyrtoceras boycei</i> r. |
| <i>Maclurites magnus</i> c, | |

F₃. Impure blue magnesian limestone, which weathers down to a shaly mass full of nodules. Contains many yellowish streaks. Corals and bryozoans numerous.

7 feet = 29 feet 3 inches.

F₄. Heavy-bedded, impure black limestone, crowded with *Maclurites magnus* and *Stromatocerium*. The fossils in these layers are

partially silicified and the weathered surface presents thousands of specimens of *Maclurites magnus*. Top of the first ledge.

7 feet 9 inches = 37 feet.

F₅. Covered.

19 feet = 56 feet.

F₆. Gray, shaly magnesian limestone, which weathers readily into a nodular mass. Fossils few.

11 feet = 67 feet.

Monotrypella sp. c,

Maclurites magnus r.

Camerella longirostris r,

F₇. Covered.

42 feet = 109 feet.

F₈. Light gray, fine-grained dolomite. Weathers light yellow. No fossils except *Leperditia canadensis*.

8 feet 6 inches = 117 feet 6 inches.

F₉. Almost black, fine-grained dolomite, breaking with conchoidal fracture. These layers contain many spots of calcite like the "birds-eyes" of the Lowville limestone. F₈ to F₁₁ was the Birdseye limestone of Emmons, 1842. The only fossils in F₉ are a few specimens of *Leperditia canadensis* and an *Orthoceras*.

5 feet = 122 feet 6 inches.

F₁₀. Light gray, fine-grained dolomite which weathers to a yellowish brown. No fossils.

5 feet = 127 feet 6 inches.

F₁₁. Like F₉, but with more calcite.

5 feet 6 inches = 133 feet.

F₁₂. Dark gray dolomitic limestone, packed full of bryozoans and sponge-like forms.

3 feet = 136 feet.

Strophochetus sp. c,

Lophospira subabbreviata c,

Bucania sulcatina r,

Leperditia limatula r.

F₁₃. About the same as the preceding, but without the bryozoa.

1 foot = 137 feet.

This is about the same as the top of C₇ of Brainerd and Seely's section. For photograph of the outcrop of layers F₈-F₁₃, see Plate XXIV.

F₁₄. Covered.

16 feet = 153 feet.

F₁₅. Impure, rather shaly limestone, with a few fossils.

2 feet = 155 feet.

Hebertella vulgaris r,

Leperditia canadensis c.

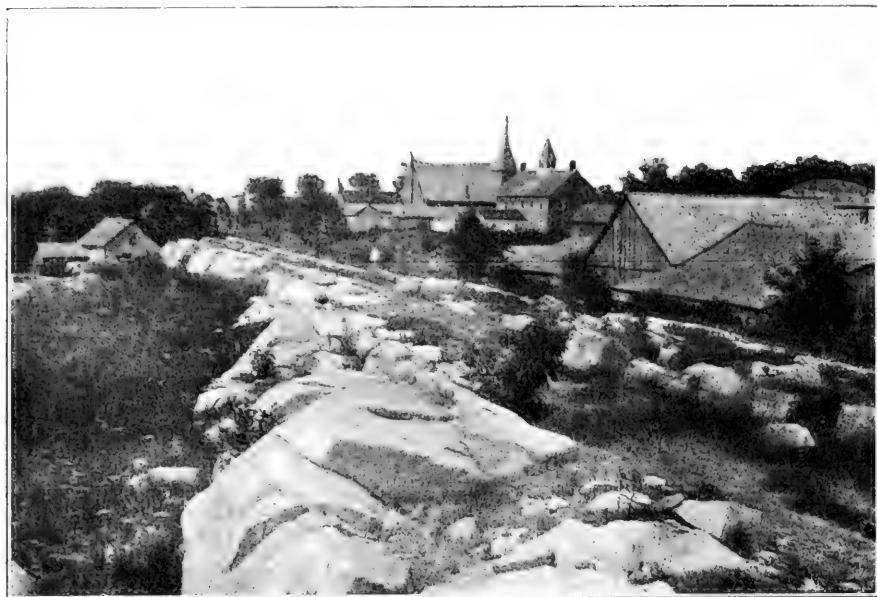
Camarotachia plena r,

F₁₆. Covered.

20 feet = 175 feet.

F₁₇. Light-gray, coarse-grained limestone, with many fragments of fossils.

2 feet = 177 feet.



F_8-F_{13} , Chazy, N. Y. The "Birdseye" of Emmons.



G. H. HUDSON, PHOTO.

Basal layers, Section A, Valcour Island.

F₁₈. Covered. 19 feet = 196 feet.

F₁₉. Coarsely crystalline, light-gray limestone, with many fragments of fossils, mostly trilobites. 4 feet = 200 feet.

Hebertella vulgaris c, *Isotelus harrisi* c,
Illænus globosus c, *Leperditia canadensis* c.

F₂₀. Six feet of blue-gray, fairly coarse-grained limestone full of *Camarotoechia plena*, capped by one foot of impure, nodular limestone. 7 feet = 207 feet.

From this point, the remainder of the section, about 60 feet, is covered. The Black River is exposed in many places on both sides of the Little Chazy River, but in no place is the exact contact of the top of the Chazy and the bottom of the Lowville limestone exposed.

Station at Chazy, New York.

Station M₁₃₃. One of the most interesting localities at Chazy is in an old sugar bush about three miles southeast of town and near the lake shore. Here there are coarse-grained blue limestones enclosing reefs of *Stromatocerium* and pure buff dolomite. In these reefs are pockets containing large numbers of large Orthoceratites, and the genera *Cyrtoceras* and *Plectoceras* are well represented. The other fossils are:

Camerella longirostris r, *Illænus erastusi* c,
Camarotoechia plena r, *Illænus globosus* c,
Holopea ? plauta R, *Amphilichas minganensis* c,
Bathyporellus brevispinus R, *Glaphurus pustulatus* c.

This fauna belongs to Division 3.

Stations at Cooperville, New York.

Station K₁₄₀. At King's Bay, Cooperville, there is a quarry which produced a large part of the stone used in building Fort Montgomery. The main body of the quarry is in a blue-gray, coarse-grained limestone which is full of crinoid and cystid fragments. The fauna consists of:

Malocystites emmonsii c, *Monotrypella* sp. c,
Malocystites sp. c, *Platystrophia platys* c,
Paleocystites tenuiradiatus c, *Rafinesquina incrassata* c,
Blastoidocrinus carchariædens c, *Maclurites magnus* r,
Bolboporites americanus r, *Orthoceras* sp. r,
Eosporgia varians c, *Cyrtoceras* sp. r,

| | |
|----------------------------------|---------------------------------|
| <i>Stromatocerium</i> sp. c, | <i>Illænus globosus</i> c, |
| <i>Strephochetus</i> sp. c, | <i>Leperditia canadensis</i> r. |
| <i>Rhinidictya fenestrata</i> c, | |

Station K₁₁₁. In the same quarry with this material occurs a pure buff dolomite which breaks with a conchoidal fracture and resembles in all respects the pure dolomite of the reefs at Chazy and Valcour Island. The lense structure of the reef is well exhibited in this quarry but there seems to be only a limited amount of the dolomite exposed.

| | |
|--------------------------------|-----------------------------------|
| <i>Camerella varians</i> r, | <i>Amphilichas minganensis</i> r, |
| <i>Orthoceras</i> , 2 species, | <i>Glaphurus pustulatus</i> c, |
| <i>Isotelus harrisi</i> c, | <i>Trilobite</i> , species ind. |

Both of these faunas indicate Division 3.

Station K₁₁₂. On the road from Cooperville Station to King's Bay, and about a quarter of a mile east of the station, is a huge boulder of limestone breccia, which contains angular limestone fragments which are full of fossils. This block of breccia is evidently an erratic, the layers on the opposite side of the road, and on which it seems to rest, being a hard, coarse-grained limestone in even layers, containing *Hebertella exfoliata* and *Zygospira acutirostris*.

The breccia contains fragments of limestone of various sorts, and the paste has furnished no satisfactory fossils, so the age of the boulder can not be determined. One of the fragments furnished *Rafinesquina alternata* and a fossil which appeared to be *Triplecia extans*, and may be of Black River or Trenton age. The largest pebbles are of Chazy age and contain the following fossils, which are sufficiently characteristic:

| | |
|---|------------------------------------|
| <i>Bolboporites americanus</i> c, | <i>Clionychia montrealensis</i> r, |
| <i>Blastoidocrinus carchariædens</i> r, | <i>Raphistoma striatum</i> c, |
| <i>Monotrypella</i> sp. c, | <i>Isotelus harrisi</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Illænus globosus</i> c. |

The species in this fauna indicate about the horizon of E₃ of the section at Chazy. This boulder was probably brought from the northeast during the glacial period, Chazy conglomerates and breccias being known about Phillipsburg and Mystic, Canada. These conglomerates are reported by Ells²⁷ as containing Chazy fossils in the paste and Beekmantown fossils in the pebbles.

²⁷ Geol. Survey Canada, volume 7, 1894, page 15.

Discussion of the Faunas of the Chazy and Valcour Island Sections.

On tabulating the preceding lists to obtain a comparative view, there are certain things which are noticeable in regard to the range of the fossils.

Cystids do not occur in the lowest hundred feet.

Bryozoa, while they begin to appear in the lower portion, are more abundant toward the middle and top.

Lingula brainerdi is confined to the basal sandstones.

Camarotoechia plena is absent from the lower 700 feet and has a range of 150 to 175 feet at the top.

Zygospira acutirostris, at Valcour Island, is most common in the lower part of the section, but at Chazy occurs quite commonly in the lower part of the range of *Maclurites magnus* as well.

Rafinesquina champlainensis is absent from the lower 100 feet and the upper 200. It never occurs with *Camarotoechia plena*.

Rafinesquina incrassata becomes most common well up in the section, at about 600 feet above the base, and occurs to some extent with *Camarotoechia plena*, although more common below the range of that species.

Plesiomys platys is rare in the lower 350 feet and seldom occurs in the upper 150 feet, its range being comparable to that of *Rafinesquina champlainensis*.

Orthis acutiplicata is confined to the lower layers on Valcour Island.

Hebertella vulgaris is not common in the lower 100 feet, but is a common fossil from that point to within a hundred feet of the top. In the lower part of the range of *Camarotoechia plena*, *Hebertella vulgaris* is its constant and abundant associate, but the species is almost absent in the upper hundred feet where *Camarotoechia plena* reaches its greatest development.

Camerella longirostris does not occur in the basal sandstones, but may be found at almost any horizon above them.

Camerella varians does not appear in the first three hundred feet, and is not often found with *Camarotoechia plena*.

Pelecypods and *gastropods* are almost absent from the lower 300 feet at Valcour Island.

Modiolopsis fabaformis is the only horizon marker among the pelecypods. It is an almost constant associate of *Camarotoechia plena* in the upper 100 feet.

Raphistoma stamineum is common at Valcour Island in only the upper

part of the section, where it has a range of about 150 feet, disappearing a hundred feet below the top. At Chazy, on the contrary, it is one of the commonest fossils in a zone 110 feet in thickness and about 200 feet above the base of the section exposed there. (That is, about 350 to 400 feet above the actual base of the formation.)

Bucania sulcatina, at Valcour Island, is most common in a 20-foot zone 345 feet above the base and again in a 100-foot zone beginning a little below the range of *Camarotoechia plena*. At Chazy it is most common in the faunule with *Scalites angulatus*, 200 feet above the base of the section. It does not become prominent above that horizon, but specimens are found all through the section.

Maclurites magnus has a comparatively restricted range in which it is common, although single specimens have been found at almost all levels. At Valcour Island it is common from the 345-foot level to the 700-foot level, a range of over 350 feet. At Chazy it ranges from the 430-foot level to the 615-foot level, only 185 feet of strata in which it is a common fossil.

Eoharpes antiquatus is not a very common fossil on Valcour Island, but it may be said that it does not occur in the lower 150 feet, or in the upper 200 feet. At Chazy it occurs near the middle of the mass.

Lonchodomas halli likewise does not occur in the lower 150 feet, but is found all through the range of *Maclurites magnus*.

Pliomerops canadensis is absent from the sandstones and most of the pure limestones, but may be found in almost any horizon where there is mud, and it occasionally occurs in great abundance in the pure dolomite of the reefs.

Isotelus harrisi, *Thaleops ovata* and *Illenus globosus* are found all through the section and are of no value as horizon markers.

Leperditia canadensis and *Eurychilina latimarginata* are also common all through the section.

Leperditia limatula, is, however, confined to a fairly definite range of a little over 325 feet, beginning at a horizon 375 feet above the base.

Division of the Chazy Section.

The study of the range of species in the Chazy sections shows that it is possible to divide the formation there into three great divisions, as at Valcour Island.

Brainerd and Seely have also divided the Chazy formation into three divisions, depending upon a combination of lithologic characters

and range of species. It will be noted that the divisions made on purely faunal grounds correspond quite closely to their divisions, although the limits of the divisions are somewhat different, especially at Chazy and Crown Point.

As a definite horizon marker, *Maclurites magnus* can not be depended upon, as it ranges all through the section. In a general way, however, when abundant, it is an indicator of a middle Chazy horizon, and if accompanied by *Rafinesquina champlainensis*, *Plæsiomys platys*, *Camerella varians* and *Leperditia limatula*, the fauna may be known as of middle Chazy age, whatever its position in the section under consideration.

Faunules in the Typical Chazy.

There are certain faunules which can be readily recognized in the typical Chazy deposits of the Champlain Valley. These are:

First. The *Lingula brainerdi* faunule. This faunule is found in the basal sandstones and shales of the Chazy formation at Crown Point, Valcour Island, Isle La Motte and South Hero, and thus marks the base of the sections throughout the region of Lake Champlain. Frequently *Lingula brainerdi* is the only fossil present other than the fucoidal markings, but at Valcour Island the faunule consists of the following species:

| | |
|-----------------------------|-----------------------------|
| <i>Lingula brainerdi</i> , | <i>Orthoceras</i> sp. ind., |
| <i>Eccyliopterus</i> ? sp., | <i>Isotelus harrisi</i> . |

This faunule ranges through only about ten to fifteen feet of rock, and is not a horizon marker, but merely indicates the base of the individual section.

Second. The *Scalites angulatus* faunule. This faunule has been found in only three localities; one of them just north of the Normal School at Plattsburgh, N. Y., and the other two at Chazy. It ranges through only a few feet of strata. Its position in the section is known only at Chazy, where it is 500 feet below the top. It has not been found on Valcour Island, the strata in which it might be expected to occur being absent from the section on the south end of the Island, where, at Pebble Beach, over a hundred feet of the lower layers are missing.

The composition of this faunule is not exactly the same at Chazy and Plattsburgh, as is shown in the following lists:

| Chazy. | Plattsburgh. |
|-----------------------------------|------------------------------------|
| <i>Scalites angulatus</i> , | <i>Scalites angulatus</i> , |
| <i>Bucania sulcatina</i> , | <i>Bucania sulcatina</i> , |
| <i>Raphistoma stamineum</i> , | <i>Raphistoma stamineum</i> , |
| <i>Raphistoma immaturum</i> , | <i>Raphistoma immaturum</i> , |
| <i>Camerella longirostris</i> , | <i>Camerella longirostris</i> , |
| <i>Illænus globosus</i> , | <i>Illænus globosus</i> , |
| <i>Thaleops ovata</i> , | <i>Thaleops ovata</i> , |
| <i>Leperditia canadensis</i> , | <i>Leperditia canadensis</i> , |
| <i>Camerella varians</i> , | <i>Malocystites</i> sp., |
| <i>Hebertella exfoliata</i> , | <i>Hebertella vulgaris</i> , |
| <i>Orthoceras</i> sp., | <i>Zygospira acutirostris</i> , |
| <i>Remopleurides canadensis</i> , | <i>Eunema historicum</i> , |
| <i>Isotelus harrisi</i> , | <i>Eurychilina latimarginata</i> . |
| <i>Pliomerops canadensis</i> , | |

Third. The *Glaphurus pustulatus* faunule. This faunule is found at Valcour Island, Chazy and Cooperville, New York, and on Isle La Motte, Vermont. It always accompanies reef conditions. These reefs are made up of great masses of *Stromatocerium* and are usually accompanied by lenticular beds of a very pure buff-colored dolomite. With the *Stromatocerium* there are usually corals and bryozoans. On Sloop Island there are great masses of *Fletcheria incerta* near the periphery of the lenticle of dolomite, and at Cooperville there are great quantities of the massive bryozoans, and *Stylærea parva*.

The fossils in these reefs occur in pockets, and while the species vary in different localities, *Glaphurus pustulatus* is always present and is always accompanied by a great number of cephalopods. On Valcour Island, the principal species of the faunule, aside from the cephalopods, are *Glaphurus pustulatus*, *Pliomerops canadensis*, *Illænus globosus*, *Illænus erastusi*, *Isotelus harrisi* and *Remopleurides canadensis*. At Chazy, neither *Pliomerops canadensis* nor *Isotelus harrisi* have been found, but *Amphilichas minganensis* is abundant. Further north, at Cooperville, the principal species are *Glaphurus pustulatus*, *Amphilichas minganensis*, *Isotelus harrisi* and *Illænus erastusi*. The faunule is composed almost entirely of trilobites and cephalopods, brachiopods being few and gastropods and pelecypods being almost entirely wanting. This faunule occurs at the base of Division 3.

*Section at Crown Point, New York.*²⁸

A₁₋₄. Thick beds of slaty shale with occasional bands of hard, fine-grained sandstone. Fucoids numerous.

25 feet 2 inches = 25 feet 2 inches.

Lingula brainerdi a.

A₃₋₈, C₁. Impure blue limestone, rather thin-bedded.

91 feet 10 inches = 117 feet.

| | |
|-----------------------------------|-------------------------------------|
| <i>Platysomys platys</i> c, | <i>Camerella longirostris</i> r, |
| <i>Hebertella vulgaris</i> c, | <i>Camerella varians</i> r, |
| <i>Rafinesquina alternata</i> c, | <i>Maclurites magnus</i> r, |
| <i>Rafinesquina incrassata</i> c, | <i>Isotelus harrisi</i> c, |
| <i>Zygospira acutirostris</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Orthidium lamellosum</i> r, | <i>Leperditia limatula</i> r, |
| <i>Lingula</i> sp. r, | <i>Eurychilina latimarginata</i> r. |

Concealed.

34 feet = 151 feet.

B₁₋₄. Impure, thin-bedded fine-grained limestone.

16 feet 6 inches = 167 feet 6 inches.

| | |
|---------------------------------------|-------------------------------|
| <i>Platysomys platys</i> c, | <i>Bucania sulcatina</i> c, |
| <i>Rafinesquina alternata</i> r, | <i>Maclurites magnus</i> r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Ctenodonta peracuta</i> R, |
| <i>Rafinesquina incrassata</i> R, | <i>Isotelus harrisi</i> r, |
| <i>Camerella varians</i> R, | <i>Thaleops ovata</i> R, |
| <i>Raphistoma stamineum</i> r, | <i>Leperditia limatula</i> c. |
| <i>Raphistoma striatum</i> R, | |

Concealed.

31 feet = 198 feet 6 inches.

B₆₋₁₆, C₃₋₁₂. Impure rather shaly limestone interstratified with heavy-bedded, fine-grained blue limestone.

80 feet = 278 feet 6 inches.

| | |
|---------------------------------------|----------------------------------|
| <i>Paleocystites tenuiradiatus</i> c, | <i>Raphistoma stamineum</i> c, |
| <i>Monotrypella</i> sp. r, | <i>Bucania sulcatina</i> c, |
| <i>Rhinidictya fenestrata</i> R, | <i>Bucania bidorsata</i> ? c, |
| <i>Platysomys platys</i> c, | <i>Lophospira perangulata</i> r, |
| <i>Rafinesquina alternata</i> c, | <i>Lophospira</i> sp. ind. r, |
| <i>Rafinesquina champlainensis</i> c, | <i>Maclurites magnus</i> c, |
| <i>Rafinesquina incrassata</i> , | <i>Orthoceras</i> sp. ind. r, |
| <i>Camerella longirostris</i> r, | <i>Plectoceras</i> sp. ind. r, |

²⁸ For a detailed description of this section see "The Crown Point Section," Bulletin of American Paleontology, number 14, 1902.

| | |
|------------------------------------|-------------------------------------|
| <i>Camerella varians</i> , | <i>Bathyporellus minor</i> r, |
| <i>Ctenodonta peracuta</i> R, | <i>Isotelus harrisi</i> c, |
| <i>Ctenodonta dubiaformis</i> R, | <i>Isotelus obtusus</i> r, |
| <i>Clionychia montrealensis</i> r, | <i>Thaleops ovata</i> r, |
| <i>Archinacella? deformata</i> r, | <i>Pliomerops canadensis</i> R, |
| <i>Archinacella? propria</i> r, | <i>Leperditia canadensis</i> c, |
| <i>Eccyliopterus fredericus</i> r, | <i>Leperditia limatula</i> c, |
| <i>Eccyliopterus proclivis</i> r, | <i>Eurychilina latimarginata</i> r. |
| <i>Raphistoma striatum</i> r, | |

C₁₃₋₁₄. Very hard, blue gray magnesian limestone, weathering so as to show alternating light and dark stripes about an inch wide.

24 feet 6 inches = 303 feet.

C₁₅. One layer of coarse-grained sandstone in which there are many cavities, as though fossils had been dissolved out. 2 feet = 305 feet.

C₁₆. Hard, magnesian limestone containing many large water-worn sand grains. 1 foot = 306 feet.

| | |
|-----------------------------|--------------------------------|
| <i>Platysomys platys</i> r, | <i>Raphistoma stamineum</i> r, |
| <i>Camerella varians</i> r, | <i>Isotelus harrisi</i> c. |

*Comparison of the Crown Point Section with those at Chazy
and Valcour Island.*

A comparison of the faunas of the sections at Crown Point and Valcour Island shows that there are many fossils common to the two sections. There are also some marked differences, particularly in the absence of sponges, corals, cystids, and of some of the common species of the sections further north, notably *Camarotoechia plena*, *Glaphurus pustulatus* and others.

The two sections are seemingly alike in having at the base a zone in which *Lingula brainerdi* is common. Above this zone, which is about twenty-five feet in thickness, the fauna is chiefly a brachiopod one, characterized by *Rafinesquina champlainensis*, *Rafinesquina incrassata*, *Platysomys platys*, *Camerella varians*, *Raphistoma stamineum*, *Maclurites magnus*, *Isotelus harrisi*, *Thaleops ovata* and *Leperditia limatula*.

This fauna contains the four species, *Rafinesquina champlainensis*, *Platysomys platys*, *Maclurites magnus* and *Leperditia limatula*, which are characteristic of the second or *Maclurites magnus* fauna at Valcour Island. This fauna at Crown Point, comes in directly above the

sandstone containing *Lingula brainerdi* (the most abundant species in the basal zone at Valcour Island), and extends to the top of the section, a range of 276 feet. While the Crown Point fauna contains the characteristic species of the second division at Valcour Island and Chazy, not all the species found in these latter localities are found at Crown Point. The Crown Point fauna does not, however, contain any species which is characteristic of any other than the *Maclurites magnus* division. The *Camarotoechia plena* fauna is entirely absent, and there is no fauna between the horizon with *Lingula brainerdi* and the horizon containing the *Maclurites magnus* fauna, the entire zone of 300 feet which occurs between these latter horizons at Valcour Island being absent at Crown Point. These facts can have but one interpretation, namely, that at Crown Point the invading Chazy sea did not arrive until at least 300 feet of strata had been deposited in the region of Chazy and Valcour Island. Further, that the basal sandstone at Crown Point, cannot, therefore, hold the horizon of the one at the base of the Valcour Island section, but is another one at least 300 feet higher in the section and representing the shore conditions of the invading sea. A peculiar feature of this sandstone is that it has the *Lingula brainerdi* of the Valcour Island basal sandstone, but as none of the other species of the *Lingula brainerdi* faunule (see page 549) are present in this bed at Crown Point the inference is that this species is generally connected with the littoral, sandy habitat and follows the invading shore conditions of the Chazy sea. This inference is in keeping with the known habitat of some of the *Lingulæ* of the present day. The facts noted therefore lead to the conclusion that the sandstone seen at the base of the different sections of the Chazy formation is not one horizon holding a definite place in the time scale, but that it is a tangential sandstone marking the base of the invading sea.

Comparison with Brainerd and Seely's Section at Crown Point.

It will be noted that this interpretation of the Crown Point section differs considerably from that of Brainerd and Seely. (See page 506 for their section.)

They assign to their division A (Lower Chazy), the basal 48 feet, of which 23 are sandstone. In their zone A₂, 25 feet in thickness, the present writer found, on collecting as large a number of species as possible, that the faunule contains three of the characteristic species^s

of the *Maclurites magnus* division, and, as has been shown above, this fact leads to the conclusion that the basal sandstone itself cannot be considered as indicating the first or *Hebertella exfoliata* division.

To their division C, Upper Chazy, Brainerd and Seely assign the upper 57 feet of the section, apparently on lithological grounds, for they note no fossils other than an undetermined species of *Bucania*. These 57 feet are almost barren of fossils, but in the top foot of the formation the writer has found the characteristic second division fossils, thus excluding the possibility of finding any upper Chazy strata in the section.

The strata of the Chazy at Crown Point thus contain the fauna of the second or *Maclurites magnus* division only.

Region North of the Canadian Line.

In the region directly north of Lake Champlain fossils have been collected and identified by members of the Canadian Geological Survey. Lists of these, by Logan, Billings, Whiteaves, and Ami, have been published at various times, from 1863 to the present, and from these lists the writer has compiled those which follow. The arrangement of the lists is according to localities, beginning with the one nearest Lake Champlain and going northward.

1. Grand Ligne quarries, directly north of Lake Champlain, and a little east of the River Richelieu.

| | |
|---|---|
| <i>Stromatocerium</i> sp. | <i>Metoptoma</i> sp. ind., |
| <i>Blastoidocrinus carchariædens</i> , | <i>Raphistoma stamineum</i> , |
| <i>Paleocystites tenuiradiatus</i> , | <i>Hyolithes</i> ? sp., |
| <i>Stictopora</i> cf. <i>glomerata</i> , | <i>Endoceras velox</i> , |
| <i>Solenopora</i> sp., | <i>Orthoceras bilineatum</i> , |
| <i>Rafinesquina</i> sp., | <i>Bathyurus spiniger</i> , |
| <i>Hebertella borealis</i> , | <i>Isotelus canalis</i> , ³⁰ |
| <i>Plesiomys platys</i> , | <i>Thaleops ovata</i> , |
| <i>Clitambonites porcia</i> , | <i>Illænus globosus</i> , |
| <i>Dalmanella perveta</i> , ²⁹ | <i>Illænus bayfieldi</i> , |
| <i>Camarotoechia plena</i> , | <i>Leperditia canadensis</i> . |
| <i>Zygospira acutirostris</i> , | |

2. Abbotsford, Quebec. About ten miles north of the preceding locality.

²⁹ This must be a species of *Hebertella*.

³⁰ Probably *Isotelus harrisi*.

| | |
|--|---------------------------------|
| <i>Blastoidocrinus carchariædens</i> , | <i>Scénella montrealensis</i> , |
| <i>Bolboporites americanus</i> , | <i>Raphistoma stamineum</i> , |
| <i>Stictopora glomerata</i> , | <i>Maclurites</i> sp., |
| <i>Rafinesquina incrassata</i> , | <i>Isotelus canalis</i> , |
| <i>Hebertella borealis</i> , | <i>Eoharpes</i> sp. |

3. St. Dominique, Quebec. About fifteen miles northeast of Abbotsford.

| | |
|--|---|
| <i>Paleocystites tenuiradiatus</i> , | <i>Trochonema umbilicatum</i> , |
| <i>Bolboporites americanus</i> , | <i>Ophileta</i> cf. <i>O. compacta</i> , |
| <i>Strophochetus</i> sp., ¹ | <i>Bucania</i> sp., |
| <i>Solenopora compacta</i> , | <i>Pleurotomaria</i> cf. <i>P. laurentina</i> , |
| <i>Fletcheria incerta</i> ? | <i>Lonchodomas halli</i> , |
| <i>Hebertella borealis</i> , | <i>Remopleurides</i> sp., |
| <i>Plasiomys platys</i> , | <i>Bathyrurus</i> sp., |
| <i>Hebertella acuminata</i> , | <i>Bathyrurus</i> cf. <i>B. angelini</i> , |
| <i>Rafinesquina alternata</i> , | <i>Isotelus canalis</i> , ³¹ |
| <i>Clionychia montrealensis</i> , | <i>Isotelus</i> cf. <i>I. gigas</i> , ³¹ |
| <i>Raphistoma stamineum</i> , | <i>Asaphus marginalis</i> , |
| <i>Liospira americanum</i> ? | <i>Illænus globosus</i> . |

4. Caughnawaga, Quebec. On the south side of the St. Lawrence River, at the head of the Lachine Rapids, west of Montreal.

| | |
|--|-------------------------------|
| <i>Blastoidocrinus carchariædens</i> , | <i>Hebertella acuminata</i> , |
| <i>Bolboporites americanus</i> , | <i>Camarotoechia plena</i> , |
| <i>Glyptocystites forbesi</i> , | <i>Raphistoma stamineum</i> . |
| <i>Hebertella borealis</i> , | |

5. Isle Montreal.

| | |
|--|---|
| <i>Malocystites murchisoni</i> , | <i>Dalmanella peroveta</i> , ³² |
| <i>Malocystites barrandei</i> , | <i>Dalmanella gibbosa</i> , ³² |
| <i>Paleocystites tenuiradiatus</i> , | <i>Dalmanella subæquata</i> , ³² |
| <i>Glyptocystites forbesi</i> , | <i>Hebertella borealis</i> , |
| <i>Blastoidocrinus carchariædens</i> , | <i>Hebertella imperator</i> , |
| <i>Bolboporites americanus</i> , | <i>Plasiomys platys</i> , |
| <i>Rhodocrinus asperatus</i> , | <i>Clitambonites porcia</i> , |

³¹ Probably *Isotelus harrisi*.

³² These are probably all *Hebertellas*, and not the species given.

| | |
|---------------------------------|-----------------------------------|
| <i>Stromatocerium rugosum</i> , | <i>Camarotoechia plena</i> , |
| <i>Monotrypella undulata</i> , | <i>Clionychia montrealensis</i> , |
| <i>Stenopora patula</i> ? | <i>Scenella montrealensis</i> , |
| <i>Phylloporina aspera</i> , | <i>Raphistoma stamineum</i> , |
| <i>Serpulites splendens</i> , | <i>Sphærexochus parvus</i> , |
| <i>Lingula belli</i> , | <i>Bathyurus angelini</i> . |
| <i>Rafinesquina alternata</i> , | |

6. Bord à Plouffe, Isle Jesus, west of Montreal.

| | |
|-------------------------------|---------------------------------|
| <i>Intricaria</i> sp., | <i>Rafinesquina alternata</i> , |
| <i>Hebertella borealis</i> , | <i>Remopleurides</i> sp., |
| <i>Plæsiomys platys</i> , | <i>Isotelus</i> sp., |
| <i>Clitambonites porcia</i> , | <i>Leperditia</i> sp. |

7. St. Martin's Junction, northwest of Montreal.

| | |
|---|---|
| <i>Blastoidocrinus carchariædens</i> , | <i>Camarotoechia orientalis</i> , |
| <i>Malocystites murchisoni</i> , | <i>Raphistoma stamineum</i> , |
| <i>Paleocystites tenuiradiatus</i> , | <i>Remopleurides</i> sp., |
| <i>Callopora</i> or <i>Calloporella</i> , | <i>Bathyurus</i> cf. <i>B. angelini</i> , |
| <i>Dicranopora</i> sp., | <i>Isotelus</i> sp., |
| <i>Stictopora glomerata</i> , | <i>Illænus globosus</i> , |
| <i>Lingula</i> cf. <i>L. huronensis</i> , | <i>Illænus</i> sp., |
| <i>Hebertella borealis</i> , | <i>Pseudosphærexochus</i> sp., |
| <i>Hebertella vulgaris</i> , | <i>Amphilichas</i> sp., |
| <i>Plæsiomys platys</i> , | <i>Eoharpes</i> sp. |
| <i>Rafinesquina incrassata</i> , | |

8. Joliette, Quebec, thirty-five miles north of Montreal.

| | |
|--------------------------------------|-------------------------------|
| <i>Paleocystites tenuiradiatus</i> , | <i>Raphistoma stamineum</i> , |
| <i>Lingula</i> sp., | <i>Bucania sulcatina</i> ? |
| <i>Hebertella borealis</i> , | <i>Orthoceras</i> sp. |

9. Hawkesbury, Ontario. Fifty-five miles west of Montreal.

| | |
|--------------------------------------|---|
| <i>Glyptocystites</i> sp., | <i>Plæsiomys platys</i> , |
| <i>Malocystites murchisoni</i> , | <i>Dalmanella perveta</i> , ³³ |
| <i>Paleocystites tenuiradiatus</i> , | <i>Zygospira acutirostris</i> , |
| <i>Bolboporites americanus</i> , | <i>Camarotoechia plena</i> , |
| <i>Cryptozoon</i> sp., | <i>Raphistoma stamineum</i> , |

³³ A *Hebertella*.

| | |
|-------------------------------|---|
| <i>Coscinium proavium</i> , | <i>Trochonema umbilicatum</i> ? |
| <i>Stictopora</i> sp., | <i>Hyolithes</i> sp., |
| <i>Ptilodictya</i> sp., | <i>Eoharpes</i> sp., |
| Monticuliporoids, | <i>Isotelus canalis</i> , ³⁴ |
| <i>Hebertella borealis</i> , | <i>Bathyurus</i> cf. <i>B. angelini</i> , |
| <i>Hebertella imperator</i> , | <i>Leperditia canadensis</i> . |

While it is not possible to refer any of these faunas to any one of the three divisions of the Chazy recognized at Chazy and Valcour Island, yet they show that all these localities are in the region of the typical Chazy fauna.

OTTAWA VALLEY REGION. AYLMER FORMATION.

1. Grenville, Canada. Fifteen miles northwest of Hawkesbury. The following section at Grenville is given on page 123 of the Geology of Canada, 1863:

(1) Concretionary limestone — Calciferous.

(2) Light to dark gray calcareous rock, with three feet of limestone at the base. Thickness 10 feet. Fossils: *Leperditia canadensis*, *Isoschilina ottawa*, and *Primitia logani* in great abundance. *Pleurotomaria pauper*, *Helicotoma umbilicata*, *Lophospira perangulata*, *Cyrtodonta faba*, *Orthoceras hisingeri* and *Bathyurus angelini*.

(3) Whitish sandstone interstratified with green shale, with vast numbers of fucoids and black phosphatic concretions. Thickness 50 feet. Fossils: Fucoids and fragments of *Lingula*.

(4) Somewhat arenaceous rock, with some black phosphatic nodules. Fossils: *Lingula*, *Camarotoechia plena*.

(5) Limestone composed almost entirely of *Camarotoechia plena*.

2. L'Original, Ontario. Across the river from Grenville.

| | |
|-----------------------------------|--------------------------------|
| <i>Malocystites murchisoni</i> , | <i>Illænus</i> sp., |
| <i>Camarotoechia plena</i> , | <i>Bathyurus</i> sp., |
| <i>Rafinesquina incrassata</i> ?, | <i>Leperditia canadensis</i> , |
| <i>Raphistoma striatum</i> , | <i>Leperditia amygdalina</i> , |
| <i>Helicotoma</i> ? sp., | <i>Ostracoda</i> . |
| <i>Orthoceras</i> sp., | |

3. Cornwall, Ontario. South of Grenville on the St. Lawrence.

| | |
|------------------------------|--------------------------|
| <i>Camarotoechia plena</i> , | <i>Primitia logani</i> . |
|------------------------------|--------------------------|

³⁴ Probably *Isotelus harrisi*.

4. Rockland, Ontario. Twenty-five miles east of Ottawa on the Ottawa River.

Hebertella imperator,
Hebertella borealis,
Platysomys platys,
Camartotachia plena,

Raphistoma stamineum,
Modiolopsis parviuscula,
Orthoceras antenor.

5. Hog Back, three miles southeast of Ottawa. List given by Dr. H. M. Ami in Report of the Geological Survey of Canada, 1899, section J, page 139.

Palaeophycus ? sp.,
Lingula belli,
Lingula huronensis,
Lingula mantelli, or
 closely allied species,
Rhynchonella plena,
Serpulites sp.,
Cyrtodonta breviuscula,
Cyrtodonta sp.,
Modiolopsis parviuscula,
Pleurotomaria calyx,
Trochonema pauperum,
Murchisonia sp.,

Cyclonema sp.,
Orthoceras cf. *O. allumettense*,
Orthoceras sp.,
Bathyrurus cf. *B. candatus*,
Bathyrurus cf. *B. angelini*,
Asaphus canalis,
Bolbocephalus ? sp.,
Isochilina amiana,
Primitia sp.,
Scolithus prolificus Mss., Ami,
Protichnites ? *sparcus* Mss., Ami,
Columnaria ? *incerta*.

6. Hog Back, near Ottawa. Species collected by the writer at the same locality as 5. The section exposed at the Hog Back measures about thirty to thirty-five feet, and in it the faunules are found in the following order, beginning with the lowest.

H. B. 1. Impure, shaly limestone, greenish in color, and very tough.

Lingula lyelli aa, *Ctenodonta parvidens* c.

H. B. 2. Greenish shale without lime.

Lingula lyelli c.

H. B. 3. Tough, fairly pure buff limestone or dolomite.

Lingula lyelli c, *Isotelus* sp. ind. r.
Camartotachia plena a,

Close to this section, but separated from it by a fault, was the following succession, whose relation to the first could not be determined.

H. B. a. Impure gray limestone which weathers to a cream-colored, soft, porous rock.

| | |
|-----------------------------------|---------------------------------|
| <i>Raphistoma stamineum</i> a, | <i>Bathyrurus angelini</i> r, |
| <i>Modiolopsis parviuscula</i> r, | <i>Isorchilina ottawa</i> r, |
| <i>Modiolopsis breviscula</i> c, | <i>Leperditia canadensis</i> c. |

H. B. b. Dark gray, pure limestone.

| | |
|---------------------------------|----------------------------------|
| <i>Leperditia canadensis</i> a, | <i>Leperditia amygdalina</i> c, |
| <i>Isorchilina ottawa</i> c, | <i>Leperditella labellosa</i> c, |
| <i>Isorchilina amiana</i> c, | <i>Primitia logani</i> . |

H. B. c. Coarse-grained, faintly pink limestone.

| | |
|--------------------------|--------------------------------|
| <i>Primitia logani</i> , | <i>Leperditia canadensis</i> . |
|--------------------------|--------------------------------|

7. Deschênes.

| | |
|-------------------------------|---|
| <i>Monticulipora</i> sp., | <i>Camarotoechia orientalis</i> , |
| <i>Hebertella imperator</i> , | <i>Pleurotomaria</i> or <i>Raphistoma</i> . |
| <i>Hebertella borealis</i> , | |

8. Aylmer, Quebec.

| | |
|--|-------------------------------|
| <i>Camarotoechia</i> cf. <i>C. plena</i> , | <i>Hebertella imperator</i> , |
| <i>Camarotoechia orientalis</i> , | <i>Isotelus canalis</i> . |

9. Aylmer, Quebec. Lists identified by the writer from his own collections and the collections made by T. W. E. Sowter.

A₁. Sandstone almost at water's edge, Main Street, Aylmer.

| | |
|------------------------------------|-----------------------------|
| <i>Hebertella imperator</i> a, | <i>Isotelus</i> sp. ind. r, |
| <i>Camarotoechia orientalis</i> c, | <i>Isorchilina</i> sp. r. |

A₂. Sandstone in the Canadian Pacific Railroad cutting east of Main Street, Aylmer.

| | |
|---|-----------------------------|
| <i>Archinacella</i> ? <i>deformata</i> r, | <i>Scalites billingsi</i> . |
| <i>Raphistoma striatum</i> , | |

A₃. Sandy shales along the trolley track, east of the preceding locality and a few feet above it.

| | |
|--------------------------|-------------------------------|
| <i>Lingula lyelli</i> c, | <i>Hebertella</i> sp. ind. r. |
|--------------------------|-------------------------------|

A₄. Light green, fine-grained clay shale, about 60 feet above Lake Deschênes.

Lingula lyelli r, *Modiolopsis sowteri* c.
Ctenodonta parvidens c,

A₅. Sandstone with the preceding.

Camarotoechia plena r, *Modiolopsis sowteri* c.

A₆. Impure yellowish limestone.

Ctenodonta sp. ind., *Holopea* sp. ind.,
Raphistoma stamineum c, *Leperditia canadensis* c.

A₇. Thin-bedded, friable shale.

Beyrichia clavigera, *Primitia* sp. ind.
Beyrichia clavigera clavifracta,

A₈. Dark gray, quite pure limestone.

Modiolopsis sowteri R, *Leperditia canadensis* a.
Modiolopsis parviuscula c,

A₉. Thin-bedded, shaly, dark blue to gray limestone on the hill east of Aylmer.

Lingula lyelli r, *Orthoceras allumettense* ? r,
Rafinesquina alternata ? r, *Ischilina ottawa* a,
Modiolopsis breviscula a, *Ischilina amiana* c.
Raphistoma stamineum,

A₁₀. Impure, dolomitic limestone overlying the Aylmer sandstone about five miles above Aylmer.

Camarotoechia plena, *Bathyrurus angelini*.

10. Allumette Island, 80 miles northwest of Ottawa.

Lingula lyelli c, *Orthoceras allumettense*.
Pleurotomaria or *Holopea*,

*Comparison of the Fauna of the Aylmer Sandstone with that of
the Overlying Limestone.*

| Sandstone. | Limestone. |
|-----------------------------------|----------------------------------|
| <i>Lingula lyelli</i> , | <i>Lingula lyelli</i> , |
| <i>Camarotoechia plena</i> , | <i>Camarotoechia plena</i> , |
| <i>Camarotoechia orientalis</i> , | <i>Rafinesquina alternata</i> ?, |
| <i>Hebertella imperator</i> , | |

| | |
|--|----------------------------------|
| <i>Modiolopsis breviuscula</i> , | <i>Modiolopsis breviuscula</i> , |
| <i>Modiolopsis parviuscula</i> , | <i>Modiolopsis parviuscula</i> , |
| <i>Modiolopsis sowteri</i> , | |
| <i>Ctenodonta parvidens</i> , | |
| <i>Archinacella? deformata</i> , | |
| <i>Raphistoma striatum</i> , | |
| <i>Raphistoma stamineum</i> , | <i>Raphistoma stamineum</i> , |
| <i>Scalites billingsi</i> , | |
| | <i>Orthoceras allumettense</i> , |
| <i>Bathyrurus angelini</i> , | <i>Bathyrurus angelini</i> , |
| <i>Isotelus</i> sp. ind., | <i>Leperditia amygdalina</i> , |
| <i>Beyrichia clavigera</i> , | <i>Leperditia canadensis</i> , |
| <i>Beyrichia clavigera clavifracta</i> , | <i>Isochilina ottawa</i> , |
| <i>Primitia</i> sp., | <i>Isochilina amiana</i> , |
| <i>Isochilina</i> sp. | <i>Leperditella labellosa</i> , |
| | <i>Primitia logani</i> . |

These parallel faunal lists show that of the twenty-five species common in the Aylmer formation around Ottawa and Aylmer, seventeen occur in the sandstone and fourteen in the limestone, six species being common to the two divisions. In the sandstone the mollusca predominate. They are represented by four species of pelecypods and four of gastropods, while in the limestone there are only two of the former and one of the latter, all three being species which come up from below. In the sandstone the ostracods are not common, nor are they sufficiently well preserved to be easily identified. In the limestones, however, the ostracods are exceedingly abundant, some layers being entirely made up of their shells. Trilobites are not numerous, either in species or individuals.

It has been suggested that the limestones of this formation should be united with the Lowville limestone above, rather than with the sandstone below. While there is a considerable change of fauna between the sandstone and limestone, as is indicated by the above lists, still the two faunas are intimately connected by six well-defined species. On the other hand, none of the species of the Aylmer limestone pass up into the Lowville limestone. The transference, therefore, of this horizon from the Chazy into the Lowville is not borne out by the faunas, the primary guide for stratigraphic determination.

*Comparison of the Chazy Fauna of the Ottawa Region with the
Typical Fauna in the Lake Champlain Region.*

The most noticeable feature of the fauna of the Chazy in the Ottawa region is the absence of the cystids, bryozoa and hydrozoa so common in the regions of the typical Chazy. Farther, the small number of species of brachiopods and trilobites is in marked contrast to the far greater variety found at Chazy and Valcour Island. On the other hand ostracods are exceedingly abundant in the Ottawa Valley, and usually rare in the Champlain Valley.

Of species common to the two regions there are seven or eight: *Camarotoechia plena*, *Camarotoechia orientalis*, *Rafinesquina alternata*, *Raphistoma stamineum*, *Raphistoma striatum*, *Archinacella? deformata*, *Leperditia canadensis* and *Hebertella borealis*. In the Champlain Valley region *Camarotoechia plena* is found only in the upper 150 to 175 feet of the section, while the other species in this list have a more extended range. The two species of *Raphistoma* are usually found more than 300 feet above the base of the section and are most common somewhere about the middle. The range of *Camarotoechia orientalis* and *Archinacella? deformata* is not known. *Rafinesquina alternata*, *Hebertella borealis*, and *Leperditia canadensis* range all through the section.

Judging from the presence of *Camarotoechia plena* and the two species of *Raphistoma*, the Aylmer formation would be correlated with the upper part of the section at Chazy. That the whole of this formation should be thus correlated is shown by the fact that *Camarotoechia plena* occurs not only in the limestone member at the top of the formation but also in the sandstones near the base.

CONCLUSIONS.

The Chazy fauna, as it is now known, consists of about 200 species distributed among the classes as follows: Hydrozoa and Spongiæ? 13, Anthozoa 3, Crinoidea 7, Cystoidea 10, Blastoidea? 2, Vermes 2, Bryozoa 10, Brachiopoda 30, Pelecypoda 23, Gastropoda 40, Cephalopoda 15, Ostracoda 12, Trilobita 38, incertæ sedes, 4.

This fauna shows a decidedly closer affinity with the fauna of the Black River and Trenton formations of New York and Canada than with the Beekmantown of the same regions.³⁵ Our knowledge of the

³⁵ The strong Mohawkian facies of the Chazy fauna suggests that the Chazy formation should be taken out of the Canadian, the Beekmantown and Chazy having very little in common.

Beekmantown fauna of the region of Lake Champlain, is, however, exceedingly incomplete, so it is not possible to make comparisons at the present time which will hold good when the Beekmantown fauna is thoroughly studied.

It can be said, however, that there is an almost complete change of species between the two formations, as only one species which is common to the two formations has so far been found. The most marked difference between the two faunas lies, however, in the general composition. In the Beekmantown, bryozoans, crinoids, cystids, and lamellibranchs are almost unknown. The brachiopods are few in numbers, and are represented by small forms including such Cambrian types as *Billingsella* and *Syntrophia*. In the Chazy, new types of brachiopods are introduced for the first time, such as *Rafinesquina*, *Strophomena* and *Camarotoechia*, genera which became very important in later faunas. Among the gastropods, *Bucania* and *Cyrtospira* are genera which make their first appearance in the Chazy and become more abundant later. The trilobites of the Beekmantown and Chazy have been compared in a previous article where it was shown that in that group there was little similarity between the two formations.

While the Black River and Trenton formations have only a few species in common with the Chazy, yet when the fossils are compared with one another it is found that almost every one in the Chazy is represented in the Trenton by a very closely allied species. With the exception of *Blastoidocrinus*, *Malocystites*, *Glaphurus*, *Heliomera*, *Bathyurellus* and *Pliomerops*, the genera pass into the formation above.

Faunal Divisions.

In the Lake Champlain region there may be distinguished three great faunal divisions of the Chazy. In these divisions, there are again various zones which are, however, more or less local geographically.

Division I: The Hebertella exfoliata Division.

The strata of this basal division are chiefly light-colored, impure, rather coarse-grained limestone. They are often heavy-bedded and frequently have shaly partings. The thickness varies from nothing at the south end of Lake Champlain to 300 feet at Valcour Island, 365 + at Chazy and 225 feet on Isle La Motte.

Characteristic fossils are: *Hebertella exfoliata*, *Orthis acutiplicata*,

Strophomena prisca, *Scenella pretensa*, *Scenellam ontrealensis*, *Palæacmæa irregularis*, *Raphistoma immaturum*, and *Scalites angulatus*.

Others which occur in this zone abundantly are: *Blastoidocrinus carchariædens*, *Bolboporites americanus*, *Zygospira acutirostris*, *Raphistoma stamineum*, *Lophospira subabbreviata*, *Bucania sulcatina*, and *Pseudosphærexochus chazyensis*.

Those which occur only rarely in this division, but which have not so far been found in the higher divisions, are *Lingula belli*, *Cyrtodonta solitaria*, *Eunema leptonotum*, and *Heliomera sol*.

Of the 141 species in the Chazy whose range is known, 64 make their first appearance in this horizon and 23 of these are found in all three divisions.

The division is characterized by the predominance of individuals and species of brachiopods, 14 of the 25 brachiopods, which occur in the Champlain Valley, being found in this division, while only 2 of the 16 pelecypods are represented. Exactly half the species of trilobites are found in this lower division, but individuals are not common. There are more of the gastropods, half the species being represented, and individuals of some of these species are very numerous. The gastropods do not occur in the lower part of the strata of this division, but are confined almost entirely to the upper part.

This division is further marked by the appearance of the earliest of American Bryozoa.³⁶ Unlike most Ordovician species, these range throughout the entire formation, above the basal sandstone.

There are three zones in this division which are worthy of notice.

Zone 1a. *The Orthis acutiplicata zone.*

This zone is near the base of the division and is found at Valcour Island and Isle La Motte. The characteristic fossils are: *Orthis acutiplicata*, *Rafinesquina incrassata*, *Isotelus harrisi*, and *Thaleops ovata*, all species with long ranges except the first.

Zone 1b. *The Scalites angulatus zone.*

The faunule of this zone is found at Plattsburgh and Chazy. It is located at the middle of the division. Characteristic fossils are: *Scalites angulatus*, *Raphistoma immaturum*, *Bucania sulcatina*, *Raphistoma stamineum*, *Camerella longirostris*, *Illænus globosus*, and *Thaleops ovata*. Only the first two are restricted to this horizon.

Zone 1c. *The Lophospira subabbreviata zone.*

³⁶According to Nickles and Bassler, *Rhinopora prima* Whitfield, from the Beekmantown, is probably not a Bryozoan.

This zone has been found only at Chazy, but it is there very strongly marked. It occurs about 75 feet below the base of Division 2.

The characteristic fossils are: *Lophospira subabbreviata* and *Raphistoma stamineum*, both of which are very abundant. Of lesser importance are the rare *Schizambon? duplimumuratus*, *Heliomera sol* and *Clionychia marginalis*.

Division 2: The Maclurites magnus Division.

The strata of this, the middle division, are usually heavy-bedded, dark-blue and gray, fairly pure limestones, with an occasional layer of gray, sparkling dolomite or of light, coarse-grained limestone. The layers near the middle weather into nodular masses, and fossils are usually poorly preserved and difficult to extract. The thickness varies from 200 feet at Chazy to 400 at Valcour Island and decreases toward the south.

The characteristic fossils are: *Maclurites magnus*, *Rafinesquina champlainensis*, *Platysomys platys*, *Platysomys strophomenoides*, *Strophochetus*, *Eospongia varians*, *Eotomaria obsoletum*, *Eccyliopterus fredericus*, *Bathyporella minor*, *Cybele prima* and *Leperditia limatula*.

The following fossils have so far been found only in this division, but most of them have been found at only one locality: *Camarotoechia pristina*, *Ctenodonta dubiaformis*, *Clidophorus obscurus*, *Whiteavia? expansa*, *Endodesma tranceps*, *Whiteavia? undatum*, *Scenella robusta*, *Raphistomina undulatum*, *Helicotoma vagrans*, *Bucania bidorsata?*, *Eccyliopterus kalmi*, *Eccyliopterus proclivis*, *Trochonema dispar*, *Subulites prolongata*, *Trochonema hudsoni*, *Holopea scrutator*, *Eoharpes otta-waënsis*, *Asaphus marginalis*, *Isotelus angusticaudum*, *Isotelus? bearsi*, *Illæus punctatus*, *Ceraurus pompilius*, *Ceraurus hudsoni* and *Pseudosphærexochus approximatus*.

This middle division is marked by the great number of species of pelecypods, gastropods, and trilobites, and is, in that respect, sharply contrasted with the lower division. Of the 23 pelecypods, 13 are represented here. Of 40 gastropods this division contains 27, and of the 38 trilobites, 27. Species of *Stromatocerium* and *Strophochetus* are common in the rocks of this division, but are also abundant in the lower zone of the next division.

Zone 2a. The Malocystites murchisoni zone.

So far only one subfaunule has been detected in this division and that is at the very base. It is best developed at Valcour, but occurs

also on Valcour Island. The zone is characterized by the great abundance of cystid fragments. The characteristic fossils are: *Cybele prima*, *Eoharpes antiquatus*, *Lonchodomas halli*, *Malocystites murchisoni*, *Malocystites emmonsii*, *Glyptocystites forbesi*, *Paleocystites tenuiradiatus*, *Raphistoma stamineum*, *Maclurites magnus*, *Plasiomys strophomenoides* and *Camerella varians*.

Division 3: The Camarotoechia plena Division.

The strata of this division are rather thin-bedded, light grey, coarse-grained limestones abounding in fossils. Near the base there are always buff-colored, pure, fine-grained dolomites and heavy-bedded, coarse-grained blue limestones. The only fossil which is found throughout this division is *Camarotoechia plena*. Other characteristic fossils are: *Camarotoechia major*, *Orthis ignicula*, *Modiolopsis fabaformis* and *Glaphurus pustulatus*. There is, in this division, a decided falling off in the number of gastropods and pelecypods, there being only six of the former and five of the latter. There are about as many trilobites, sixteen, in this division as in division 1, and eight of these are found in all three divisions. Brachiopods, in the matter of number of species, are very uniform through the section, as there are 13 known in each division at the present time. They dominate the fauna in both the first and third divisions, but in the first division it is one of the Protremata (*Hebertella*), while in the third division it is one of the Telotremata (*Camarotoechia*) which is most abundant.

There are three well-marked zones in this division:

Zone 3a. *The Glaphurus pustulatus zone.*

This zone is found at the base of Division 3 at Valcour Island, Chazy, Cooperville, and Isle La Motte. The characteristic fossils are: *Glaphurus pustulatus*, *Illænus globosus*, *Illænus erastusi*, *Isotelus harrisi*, *Remopleurides canadensis*, *Pliomerops canadensis*, *Amphilichas minganensis*, *Pseudosphærexochus vulcanus*, *Camarotoechia plena*, *Conocardium beecheri*, *Bucania sulcatina*, and several cephalopods.

Zone 3b. *The Camarotoechia major zone.*

This zone stands between 3a and 3c and its faunule is a transition between the two. *Camarotoechia* becomes more abundant and better developed, and the trilobites and brachiopods become fewer in species. The best development is at Valcour Island. Characteristic fossils are: *Camarotoechia plena*, *Camarotoechia major*, *Hebertella vulgaris*, *Orthis ignicula*, *Malocystites emmonsii*, *Malocystites sp.*, *Paleocystites sp.*,

Illænus globosus, *Pliomerops canadensis*, *Bucania sulcatina*, *Raphistoma stamineum* and *Isotelus obtusum*.

Zone 3c. *The Modiolopsis fabaformis zone.*

In this zone *Camarotoechia plena* is abundant almost to the exclusion of other species. The faunule extends to the top of the formation at Chazy, Grand Isle, and Valcour Island. The characteristic fossils are *Camarotoechia plena* and *Modiolopsis fabaformis*.

Canadian Exposures.

North from Valcour Island and Chazy the various divisions cannot be followed in the lists published, but this is due to the fact that no sections have been carefully studied in that region. The various lists published by the Canadian Survey and copied on the preceding pages do show, however, that fossils characteristic of all three of the divisions are found in that region. The Champlain Valley fauna is found as far north as Joliette, 35 miles north of Montreal and about 85 miles north of Chazy. To the west, it is found again at Hawkesbury, 75 miles in a straight line from Chazy and 55 miles from Montreal, showing a considerable area through which the fauna is distributed.

West from Hawkesbury, a decided change in the fauna is found at L'Original, only 16 miles distant. Here is found a section less than 200 feet in thickness, with sandstone at the base and limestone in the upper portion. The fauna changes very abruptly, as several species of ostracods that are unknown farther east, are found here. The other fossils are: *Camarotoechia plena*, *Raphistoma stamineum*, and *Malocystites murchisoni*. From this locality west to Allumette Island, a distance of 115 miles, the same succession of strata may be found and about the same fauna, but with some differences. At L'Original the ostracod layers are below a fifty-foot bed of sandstone. In the sections farther west, the ostracods occur in the limestone layers overlying the sandstone. Again, it is noticeable that the farther west from Grenville the locality is, the fewer typical Chazy species are found. All through the Ottawa Valley the Chazy is represented by a formation which is sandstone at the base and limestone in its upper portion.

The basal beds of the Chazy are always sandstone, but this sandstone does not carry the same fauna in all regions, nor do the strata which rest upon it always carry the same fauna. In the region of Lake Champlain, the sandstone always carries *Lingula brainerdi*. In

the Ottawa Valley region the sandstone carries a modified *Camarotoechia plena* fauna. At the typical sections the *Lingula brainerdi* faunule is at the base of the formation, while the *Camarotoechia plena* fauna comes in 700 feet above the base.

Since the fullest development of the limestone deposits of this age is found in the region of Chazy and Valcour Island, that region must represent the place in which the Chazy sea persisted longest. From the evidence outlined in the preceding pages, it would seem that in this region there was a shallow sea invading south and west on a slowly sinking land. Since the Chazy fauna seems to be developed less directly from the Beekmantown fauna of the Lake Champlain region than from that of Newfoundland, and since new European types are added to the American fauna during Chazy time, it seems probable that the sea was more constant and open toward the east or northeast.

If the sea were invading upon the land to the south and west, the sandstone in the Champlain Valley would represent shore conditions, and should be younger in age as it is traced south and west. That this is the case is shown by the faunas. At Valcour Island there were 300 feet of rock deposited during Chazy time before the *Maclurites magnus* fauna became prominent, while at Crown Point, 40 miles south, this fauna follows immediately upon the sandstone at the base of the section. Evidently during a large part of Chazy time the transgression was southward, but later it began to move westward. The region now occupied by the Ottawa Valley was then invaded, and the sea brought with it a part of the *Camarotoechia plena* fauna. The date of this invasion to the west can be approximated, for in the middle of the section at L'Original, *Camarotoechia plena*, *Raphistoma stamineum*, and *Malocystites murchisoni* are found. At Valcour Island these three species are found together in Zone A₃₉, 775 feet above the base, thus showing that the formation in the Ottawa Valley represents only the very latest part of Chazy time.

Ulrich and Schuchert bring out this idea of a sea invading westward and southward in their paper on Paleozoic Seas and Barriers (Report New York State Paleontologist, 1902, page 639). They state: "With the earlier part of the subsidence [the Chazy invasion] the Atlantic invaded the continent westward . . . The typical Chazy formation . . . bears evidence in its members of having encroached southward and westward in the arms, the latest beds . . . extending furthest south and west."

The Closing Period of Chazy Time.

In the preceding pages an effort has been made to show that in northeastern New York and southern Canada, the Chazy sea invaded over a land surface of Beekmantown rocks, and that the base of the Chazy is a tangential sandstone.

Of the former extent of the formation there are few hints. Since the sea did not attain the region of Aylmer until very late Chazy time, it is probable that the formation never extended much west of the known outcrops in that region (Allumette Island, etc.).

From a study of the stratigraphy and faunas it becomes evident that the upper portion of the Chazy is not represented in the region south of Valcour Island. Either these beds were not deposited there, or they were eroded before the Lowville limestone was laid down. The evidence is not of such a character as to prove definitely which did occur, but for reasons to be given it seems more probable that the upper beds were deposited south of Valcour Island and later eroded. These reasons are as follows:

First. The sandstone immediately following the Chazy throughout the Champlain Valley may be interpreted as the invading base of the Lowville (Upper Stones River). From this it would follow that a period of erosion existed between the Chazy and Lowville.

Second. The other supposition is that the Chazy sea advanced slowly to the south to some place below Orwell, Vermont, and then retreated to the northward. Such a retreat could have been caused only by an elevation south of Orwell, as there is no general retreat of the Chazy sea at this time, proven by the fact that at a still later time the sea advances to the vicinity of Aylmer and Ottawa. That there was no uplift at that time in the south is shown by the fact that the Stones River invasion from the southwest comes first upon the eroded Beekmantown and then over the various horizons of the Chazy as it proceeds northward. The conclusion from these facts is that the Chazy sea invaded southward to the region of Orwell, depositing here the final (*Camarotoechia plena*) beds of the formation. The Chazy sea then vanishes from the area of Lake Champlain, and while this is going on, the Stones River sea invades from south to north. During this time of Stones River advance and Chazy retreat, there was a land interval, in which some of the Chazy and Beekmantown beds were removed along the barrier region between Orwell and the Mohawk Valley.

Third. By taking the decrease in thickness of Division 1 between Chazy and Valcour Island (11.25 feet per mile) to compute the probable southern extent of that division, it is found that it would have

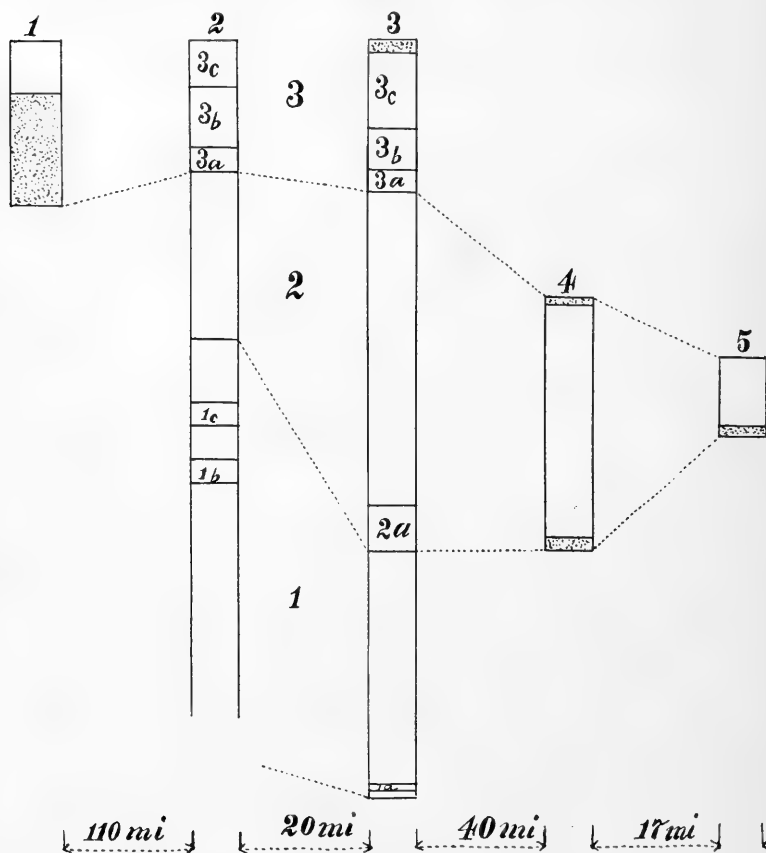


FIG. 3. Diagram to show the relations of the various sections. 1, Aylmer, Province Quebec; 2, Chazy, New York; 3, Valcour Island, New York; 4, Crown Point, New York; 5, Orwell, Vermont. In vertical scale 1 inch equals 225 feet. The distance between the various sections is given, in miles, on the line at the base of the figure.

reached only 26.6 miles south from Valcour Island. At the same rate of decrease, the base of the Crown Point section is 461 feet higher than the base of the Valcour Island section. It is not known that this rate of decrease held, however, as there is no third point in the

north and south line as a check. It is known, however, that the thickness of Division 1 at Valcour Island is 300 feet, and of the same division at Crown Point is 0, a thinning of 7.3 feet per mile. If this factor is not correct, it is too small. Taking this as a basis, the base of the Crown Point section is at least 300 feet above the base of the Valcour Island section, and the base of the Orwell section at least 424 feet above the base of the Valcour Island section. (See Fig. 3.)

If this minimum estimate of the height of the base of the Crown Point section above the base of the Valcour Island section be used, it will be seen that the Crown Point section lacks the upper 285 feet of the formation. This is a gradient, to the top of the beds at Valcour Island, of 6.95 feet per mile. Taking the base of the Orwell section at 424 feet, the upper 407 feet are lacking. The thinning in the 17 miles from Crown Point to Orwell is 122 feet, or 7.1 feet per mile, while the gradient to the top of the Chazy at Valcour Island is 7.01 feet per mile. The close correspondence of these gradients and the small gradient, 7 feet per mile for a distance of 58 miles, are significant and seemingly indicate a base leveled land during the Chazy-Lowville interval.

REPRESENTATION OF CHAZY TIME IN OTHER REGIONS.

The Chazy was formerly identified by various geologists as covering a large area, extending south along the Appalachian Mountains as far as Georgia, and occurring in Kentucky, Wisconsin, Michigan, Minnesota, and in the southern part of the Rocky Mountains. More recently it has been held that while certain formations may have been laid down during Chazy time, the typical Chazy rocks and fauna are restricted to the region of the Champlain and Ottawa Valleys and the Mingan Islands. Among the formations correlated in time with the Chazy are the St. Peter sandstone, the lower part of the Stones River group, and the Blue Limestone of Lenoirs, Tennessee.

The St. Peter Sandstone. — This formation has long been correlated with the Chazy. It is best developed in Minnesota, Wisconsin, Iowa and Illinois, where it underlies the lowest member of the Mohawkian series. The fauna of this formation, described by Sardeson (Bulletin of the Minnesota Academy of Sciences, volume IV, number 1, part 1, page 64, 1894), consists principally of mollusca, which have a decided affinity with Mohawkian forms. None of the species are found in the typical Chazy. This fauna, in the neighborhood of

St. Paul, Minn., occurs at two horizons, one near the middle of the formation, and the other near the top.

James correlated the St. Peter on lithological grounds with the Chazy of the Ottawa Valley, but there are no species common to the two formations, and lithological characters signify little when the faunas can be compared.

From the close relationship of the St. Peter fauna to that of the Mohawkian, it seems probable that this formation was deposited during Stones River time.

Stones River Group. — In the Columbia folio of the United States Geologic Atlas, Ulrich has correlated in time the lower part of the Stones River Group, including the Lebanon, Ridley, Pierce and Murfreesboro limestones, with the Chazy of New York. This correlation is evidently based mainly on stratigraphic grounds, as Ulrich and Schuchert in their article on Paleozoic Seas and Barriers, have held that the Lowville of New York is the northeastern representative of "the extreme top of the Stones River" Group.

In the Columbia folio referred to above, Ulrich has tabulated the fossils of all the divisions of the Stones River Group, as developed in the middle Tennessee region. In the Lebanon limestone, the upper member of the Stones River Group which is there correlated with the Chazy, there are, according to the table, 37 species, beside ten undescribed Bryozoa. Of these 37 species, seven are Bryozoa and five are not specifically identified. This large number of Bryozoa, 17 species, would at once suggest that the formation which contained them is much more closely allied to the Trenton than to the Chazy. Leaving out of account the Bryozoa, which, in the Ordovician, nearly always have a very restricted range, and the five forms not specifically identified, it is found that seventeen of the twenty-five species remaining are Black River or Trenton forms. All the brachiopods, four of the five gastropods, and two of the three trilobites are species found in higher formations. Even if all the described species be included, 53 per cent. of the species of the Lebanon limestone are Mohawkian forms.

Below the Lebanon is the Ridley limestone, about 80 feet in thickness. Of the nine species listed from this horizon, six are found in the Black River.

Below the Ridley is the thin Pierce limestone with twelve species listed, and twenty undescribed bryozoans. Only eleven forms are

specifically identified, and of these 30 per cent. are Mohawkian species.

The lowest member of the Stones River Group is the Murfreesboro limestone, which is about 60 feet thick and contains 24 species, 21 of which are identified. The fauna is composed principally of mollusca, gastropods of the genera *Lophospira* and *Liospira* being particularly abundant. Of the 21 species, 11 are Black River or Trenton, so that 52 per cent. of the species of this oldest member of the Stones River Group belong to the Mohawkian.

Thus, of the 58 described species occurring in these four divisions of the Stones River Group, 27, that is, 46 per cent., occur in the Mohawkian.³⁷ Comparing this large percentage of forms common to the Stones River and the Black River and Trenton, with the low percentage, less than 5 per cent., of forms common to the Chazy and Mohawkian, it becomes evident that the Stones River and Trenton faunas are much more closely connected than are the Chazy and Trenton faunas. This close relationship, faunally, of the Stones River and Trenton, coupled with stratigraphy, suggests that the whole Stones River is younger than the Chazy.

The Blue Limestone of Lenoirs, Tennessee. — The *Maclurea* limestone of East Tennessee was correlated by Safford with the Chazy or Black River of New York and Canada, and Ulrich and Schuchert have held that the deposits of their *Lenoir Basin* were made during Chazy time. A section at Lenoirs afforded the writer a small fauna containing fossils characteristic of Division 2 in the Lake Champlain region, and it is possible that the typical Chazy fauna may exist at Lenoirs, but the region needs further study before definite correlation is made.

RELATION OF DIVISIONS 1, 2, AND 3, TO CUSHING'S SUBSTAGES.

In a recent article (Bulletin New York State Museum, number 95) Professor Cushing has proposed names for the three divisions of the Chazy as limited by Brainerd and Seely. Their basal division, *A*, is called the Day Point limestone, division *B*, the Crown Point limestone, and *C*, the Valcour limestone. These divisions are proposed because they are "sharply marked off from each other lithologically

³⁷ Of course these percentages will be modified when the whole Stones River fauna is known. As the Stones River and Chazy faunas occupy different basins, positive correlations cannot be drawn by this method.

and may easily be mapped on the scale of one-inch maps." As is explained on a preceding page, the divisions *A*, *B*, and *C*, of Brainerd and Seely, being based to some extent on faunal evidence, correspond in a general way with the faunal divisions 1, 2, and 3 of the present article, but with a considerable difference in their upper and lower boundaries in the various sections. If the formation is to be subdivided on lithologic grounds, these divisions suggested by Cushing are probably the best that could be chosen. The best test of their utility is to examine the geologic maps which accompany Cushing's article. In most cases the colors of these maps correctly represent the faunal divisions, but two exceptions may be noted. At Valcour, New York, all the region from the Valcour Fault north to Day Point is colored as Day Point limestone (Lower Chazy) while the fauna shows that the strata of this region belong to the Middle Chazy, and the Lower Chazy is met with north of Day Point only. Again, at Chazy there is a large region southeast of the village colored as Crown Point limestone (Middle Chazy), but the fauna shows that about half of this area, east of the north and south highway, belongs to the upper Chazy.

The Day Point limestone, Crown Point limestone, and Valcour limestone as defined by Cushing are not true faunal units, and could not be distinguished outside of the region between Chazy and Valcour Island, New York.

DESCRIPTION OF NEW SPECIES.³⁸

Brachiopoda.

Crania prona sp. nov.

Ventral valve flat, or conforming to the object of cementation, to which it is attached by its whole surface. Dorsal valve depressed, conical, subrectangular in outline, usually wider than long. Apex not prominent, a little posterior to the center. Surface marked by strong, concentric lamellæ of growth. On some specimens these lamellæ are worn smooth, while on others they turn upward, producing a rough surface.

³⁸ These species, like those described in the *American Journal of Science*, Volume XX, are described at this time without illustration only because it was necessary to do so to make the faunal divisions. Figures are now being prepared, and will be published in the next number of these ANNALS.

The interior of the dorsal valve frequently shows the muscle scars well. Just behind the center of the valve are two strong elevated scars, the posterior oclusors, and directly in front of them are two depressed scars, the anterior oclusors. Between these, but a little further from the center, are two depressed scars, the dorsal adjustors. Behind the posterior oclusor scars is a depression which sometimes appears divided by a narrow ridge into two scars. These scars probably belong with the two long lunate vascular scars which are situated outside the oclusors and which reach nearly to the front of the shell. On a few specimens two more pairs of scar-like markings appear—one pair along the posterior margin, and one pair on the lateral margin near the front.

Locality. — Found at Chazy and on Sloop Island, Valcour Island, New York.

Rafinesquina distans sp. nov.

Shell small, nearly flat, about three fourths as long as wide. The greatest width is at the hinge. The sides and front are regularly rounded. The surface is marked by eight to twelve prominent striæ, between each pair of which are groups of ten to fifteen very fine striæ. There is no other species of *Rafinesquina* in the Chazy on which the principal striæ are so widely separated, so it can easily be distinguished by that character.

Locality. — Crown Point and Valcour Island, New York. In the upper Chazy.

Gastropoda.

Archinacella ? propria sp. nov.

Shell of medium size, almost circular in outline, depressed, conical, rising to an acute apex which is situated half way between the center and anterior margin. Beak small, scarcely incurved, directed forward. Anterior slope concave directly under the beak, but straight for the greater part of the slope. Posterior slope long and slightly convex. The surface shows a few very fine concentric lines. The greater diameter of the aperture is 18.5 millimeters, and the lesser 17.5.

Locality. — Fairly common at Crown Point, Valcour and Chazy, New York. Usually occurs in the *Maclurites magnus* division of the Chazy.

Raphistomina undulatum sp. nov.

Shell small, having four or five whorls; lenticular; the spire rather high, and the under portion rounded, depressed, not subconical as in *Raphistoma stamineum*.

The surface of the first three or four volutions, in the cast, is smooth, but marked by numerous small folds which run from the suture diagonally forward across the surface of the volution. The margin is acute, rounded and just beneath the margin is a narrow concave space. Below this the shell is gently convex for a short distance, then flat to the umbilicus, which, in the cast, is open.

Locality. — This shell has, so far, been found only in the middle Chazy at Sloop Bay, Valcour Island, New York.

Bucania catilloides sp. nov.

Shell very small, compressed, with two or three whorls which expand gradually. The carina is narrow but distinct and slightly elevated. The form is much like that of *Bellerophon acutus* Hall, but the umbilicus is wide enough in the present species to expose all the whorls. On none of the specimens are the surface markings preserved.

Locality. — A very rare fossil found so far only on the west side of Valcour Island, where it is associated with *Bucania sulcatina*, *Zygospira acutirostris* and species of *Phylloporina*.

Eccyliopterus kalmi sp. nov.

Shell small, loosely coiled; apex acute, incurved, but not making a closed volution. The shell is roughly rectangular in cross section, flattened on top, sloping outward and downward on the side and obtusely angulated at the lower angle; rounded below and on the inside. The specimen is a cast and does not show any surface markings. This species may be separated from both *Eccyliopterus fredericus* and *Eccyliopterus proclivis* by its subrectangular cross-section.

Locality. — A rare fossil at Sloop Bay, Valcour Island, in the middle Chazy. Named for the explorer and naturalist, Peter Kalm, who visited this region in 1749.

Eccyliopterus proclivis sp. nov.

Shell loosely coiled, apex acute, scarcely incurved. Cross-section of cast triangular. Upper surface flat, the lower acutely angulated. Both inner and outer sides are gently convex. The cross-section of this shell easily separates it from the preceding.

Locality. — A very rare fossil in the Chazy at Crown Point, New York.

Gyronema ? rosalinea sp. nov.

Shell of good size for this genus, with about five whorls and an acute spire. The whorls expand gradually below, the body whorl occupying about half the length or a little less. All the whorls are robust, nearly circular in section. The sutures are deep. The first three whorls are smooth, but the last two show four or five revolving ridges on the lower side of the whorl, the upper half being smooth. The height is 18 millimeters; the width of the last whorl 14 millimeters. The aperture is large and rounded. The umbilicus is not shown by the present specimens.

Locality. — Found in the middle division of the Chazy at Valcour Island, New York.

Holopea ? plauta sp. nov.

Shell small, depressed. Spire scarcely elevated above the level of the body whorl. There are usually two and a half or three volutions, the body whorl expanding very rapidly. Along the outside and at about the middle of the main whorl is a slight ridge, and below this revolving ridge are a series of low, broad folds running back into the umbilicus. With this exception the surface is smooth. The aperture is rounded below and rather acute above. The umbilicus is very wide.

Locality. — A rare shell found in division 2 at Valcour Island, and in zone 3a at Chazy, New York.

Pelecypoda.

Ctenodonta ? bidorsata sp. nov.

Shell small, longer than high. Hinge back of beak nearly straight, rather long. Anterior end of shell short and broadly rounded. The lower margin is gently convex, and the posterior margin short and acute. The interior cast is marked by two narrow sinuses which radiate from the beak. The anterior one runs almost directly across the height of the valve, while the posterior one runs diagonally to the posterior margin. In front of the anterior sinus, and behind the posterior one are narrow ridges. The casts are only slightly convex, highest at the umbo, and concave along the hinge margin. An average specimen is 11 millimeters long and 7 millimeters high.

Locality. — Division 2 of the Chazy limestone, Valcour Island, New York.

Whiteavsia ? expansa sp. nov.

Shell oval in outline, only moderately convex, with a strong ridge running diagonally from the beak to the lower angle of the posterior margin. The slope from this ridge to the hinge and posterior margin is abrupt and rounded. To the basal margin the slope is gradual and almost flat. The internal cast shows a small but distinct anterior muscle scar and strong concentric growth lines which are especially strong on the umbonal portion of the shell.

An average specimen is 19 millimeters long and 14 millimeters high.

Locality. — In the middle Chazy at Valcour Island, New York.

Cyrtodonta scala sp. nov.

Shell small, strongly convex, the anterior lobe small and depressed. Posterior margin semicircular. Slope from the umbo to the posterior margin more gentle than that to the anterior edge. One specimen has a length of 11 millimeters and a height of 9 millimeters.

Locality. — In the black limestone of the middle Chazy at Valcour Island, New York.

Whiteavsia ? undatum sp. nov.

Shell rather small for the genus, robust, the upper and lower margins subparallel. Beak elevated, small. A broad, shallow depression extends from the umbo to the basal margin, giving the shell a flattened appearance. Posterior margin regularly rounded; anterior margin almost straight, meeting the hinge at almost a right angle. From the umbo an oblique ridge extends to the lower anterior angle of the shell, and the slope from this ridge to the front is steep. Length of one specimen, 25 millimeters, height 12.5 millimeters.

Locality. — The middle Chazy on Valcour Island, New York.

BIBLIOGRAPHY.

In the following pages an attempt has been made to cite all of the more important papers on the Chazy formation or its fauna. It has not been the intention to give abstracts of the papers, but where they contain valuable information not brought out elsewhere in this article,

or contain views opposed to the theories put forward in the preceding pages, quotations or abstracts are made. Some papers are included in the list which are of historical interest only, while several papers, in which other formations have been incorrectly correlated with the Chazy, are intentionally omitted.

1770. KALM, PETER. A Journey to North America. Translated by John Reinhold Forster.

The first naturalist who wrote about the region of the typical Chazy deposits appears to have been Professor Peter Kalm of the University of Abo, in Swedish Finland. He passed through the Champlain Valley in 1749 on his way to Montreal. He wrote a considerable account of the geology of Crown Point, which has already been quoted by the present writer in Bulletin of American Paleontology, no. 14, 1902. Of the geology of the region north of Crown Point he says little.

1817. MCCLURE, WM. Transactions of the American Philosophical Society, New Series, No. 1, 1817, p. 38. Observations on the Geology of the United States.

The geology of the Lake Champlain region is described briefly as follows:

"Secondary class: This extensive formation occupies a surface from two hundred to five hundred miles in breadth. The horizontal limestone and slate skirt Lake Champlain about Ticonderoga and Crown Point, and for a considerable distance down the east side of the lake, seldom extending above half a mile from the edge of the water; containing some shells and flints, as on Lake Erie, and appears to be the same formation as on Lake Erie.

"Vermont lays to the westward of the New England States, and occupies part of that range of mountains, running north and south in the direction of the stratification, nearly twenty or thirty miles from Lake Champlain and parallel to it. Two classes of rock occupy the whole state; the transition, which extends along Lake Champlain and is about twenty-five miles broad, where the primitive begins and continues until it joins the frontiers of New England."

1818. LE SUEUR, C. A. Journal of the Academy of Natural Science, Philadelphia, Vol. 1, p. 312. Describes and figures *Maclurites magnus* from the limestones of the Lake Champlain region.

1841. EMMONS, EBENEZER. Final Report on the Geology of the Second District, New York, p. 107.

As this is the earliest mention of the name *Chazy Limestone*, a large part of the original description is quoted.

"To the calciferous sand rock succeeds the Chazy limestone. As a whole, it is a dark, irregular, thick-bedded limestone. At Chazy it contains many rough, irregular, flinty or cherty masses which have been found in places once occupied by a species of stone coral. It appears to have been a *Colum-*

naria, but generally the columns are so obscure and broken that it is difficult to determine the nature of the fossil.

"The mass is not uniformly of the character described. At Essex the beds are more regular, and presents externally a better aspect, and forms in consequence a better building stone. As a limestone, it is purer than the calciferous.

"The position of the Chazy limestone is clearly defined at Chazy, lying between the calciferous and birdseye limestone.

"There are three well-marked fossils which make their appearance in this rock; the *Maclurea*, a *Trochus* and a *Columnaria*. Beside these, there are numerous small fossils, which the irregular bedding of the rock conceals.

"The entire thickness of this rock is not far from 130 feet. It is developed at numerous localities along Lake Champlain, particularly at Essex, and at Chazy in Clinton County."

In a footnote referring to *Maclurea*, Professor Emmons says: "This fossil was first described by C. A. Le Sueur under the generic name *Maclurites*, in honor of William McClure. As the termination of this name is evidently erroneous, I propose to change it as above, in order to preserve the commemoration intended to a most munificent patron of science."

On succeeding pages he describes the occurrence of the Chazy at Crown Point and Essex, and gives a good figure of *Maclurites magnus*. On page 315 the strata at Chazy are described. The lower part of the section is assigned to the calciferous sand rock and the upper part included in the Birdseye limestone, thus leaving only the middle portion as the original Chazy. The fossils of the Chazy formation at Chazy are: "The *Maclurea* is most abundant. . . . A much smaller species is common at Chazy, in which the thickness is the greater portion of the disk. . . . In the mass above the oölite, numerous orbiculæ³⁹ appear. These are quite deep, or rather conical, and we find only the convex valve."

1845. ADAMS, C. B. First Annual Report of the State Geologist of Vermont, p. 44.

In describing the economic products of Isle La Motte, the author speaks briefly of some quarries in the Chazy.

"At Hill's quarry, on the east side, *Maclurea* is often found, and specimens sometimes reach five inches in diameter.

Cook's quarry, on southeast end of the island. Strike N. 65° E. dip 4° or 5° to northwest. The beds show corals, encrinites, and *Maclurea*.

Fisk's quarry on southwest end of island. This is the most extensive marble quarry in Vermont and was wrought before the war of the Revolution. Strike, north and south. Dip 5° or 6° east. The rocks consist chiefly of fragments of corals, with *Maclurea* in abundance, and a small *Orthoceras* and other chambered shells. One *Maclurea* was seven inches in diameter."

³⁹ Evidently species of *Archinacella* and *Scenella*.

845. BAYFIELD, CAPTAIN H. W. On the Junction of the Transition and Primary Rocks of Canada and Labrador. Quarterly Journal of the Geological Society of London, Vol. 1, p. 450. In discussing the Mingan Islands, this author writes:

"The Mingan Islands are entirely composed of limestone, having a slight dip to the southward. So also is the Island of Anticosti, which, from its position to the southward, and similar dip, may be expected to be higher in the Silurian series. The limestone of these islands resembles that of Lake Huron, which is very nearly horizontal, although there is a slight dip, which, continued for many miles, must give a very considerable thickness to the whole range, measuring from the lower beds that rest on the granite of the mainland to those that dip gradually beneath the sea on the southern coast of Anticosti, to form the summits of the unvisited ridges of the interior of the island, five or six hundred feet above the sea.

"The following are the most abundant fossils of the islands of Mingan:

- | | |
|----------------------------------|---|
| 1. <i>Illenus crassicauda</i> , | 5. <i>Terebratula plicatella</i> (non Sowerby), |
| 2. <i>Orthoceras duplex</i> , | 6. <i>Euermis</i> ? |
| 3. <i>Orthoceras annulatus</i> , | 7. <i>Leptæna Humboldtii</i> , |
| 4. <i>Euomphalus</i> , | 8. <i>Pleurotomaria</i> ." |

The fossils were identified by de Verneuil.

1846. ADAMS, C. B. Second Annual Report of the State Geologist of Vermont.

In the second report of the Vermont State Geologist, the name Chazy is not used, but the name Isle La Motte limestone substituted for it in describing a section from Snake Mountain to the lake, and in a section at Larabee's Point, Shoreham.

On page 39 is a wood cut, labeled a "chambered shell, Fisk's quarry, Isle La Motte." It is an outline drawing and too poor an illustration to be identified, but is interesting as the first figure of a Chazy cephalopod.

1846. EMMONS, E. Agriculture of New York, Comprising an Account of the Classification, Composition and Distribution of the Soils and Rocks and the Natural Waters of the Different Geological Formations, Together with a Condensed View of the Climate and Agricultural Productions of the State.

1847. HALL, JAMES. Paleontology of New York, Vol. 1.

In the first volume of the New York State Paleontology, a considerable number of Chazy fossils are described and illustrated, and a few observations made upon the formation as a whole. That a part of the formation was still referred to the Birdseye is shown by the fact that *Calymene multicoستا* (*Phiomerope canadensis*) was described from the "Birdseye" of Isle La Motte.

1847. DE VERNEUIL, E. Note sur le Parallélisme des Roches des Dépôts Paléozoïques de l'Amérique Septentrionale avec ceux de l'Europe, Suivie d'un Tableau des Espèces Fossiles Communes aux Deux Continents, avec l'Indication des Étages où elles se Recontrent, et Terminée par un Examen Critique de Chacune de ces Espèces. Bulletin of the Geological Society of France, Series 2, Vol. 4, pt. 1, pp. 646-707.

In this epoch-making article the Chazy is discussed very briefly as follows :

"In New York the Black River limestone includes the Chazy and birds-eye limestones. Some forms are peculiar to this formation, such as *Lituites* and *Maclurites*.⁴⁰ The trilobites, as yet not numerous, are represented by the genera *Illænus* and *Isotelus*; the Orthoceratites by *Ormoceras* and *Endoceras*. The brachiopods are represented by the genera *Orthis*, *Lepæta* and *Terebratula*."

1850. d'ORBIGNY, ALCIDE. *Prodrome de Paleontologie*, Tome 1.

Lists of the fossils of the Chazy limestone, following Hall.

1852. HUNT, T. S. *Examinations of Phosphatic Matters, Supposed Bones, and Coprolites, Occurring in the Lower Silurian Rocks of Canada*. *Quarterly Journal of the Geological Society of London*, Vol. 8, p. 209.

Among other things analyzed was a concretion from the Chazy limestone at Hawkesbury. The results were as follows :

| | |
|---------------------------------|-------|
| Phosphate of lime..... | 44.70 |
| Carbonate of lime..... | 6.60 |
| Carbonate of magnesia..... | 4.76 |
| Oxide of iron..... | 8.60 |
| Insoluble siliceous matter..... | 27.90 |
| Volatile matter..... | 5.00 |
| | <hr/> |
| | 97.66 |

1852. LOGAN, SIR W. E. *On the Footprints Occurring in the Potsdam Sandstone of Canada*. *Quarterly Journal of the Geological Society of London*, Vol. 8, p. 200.

In discussing the stratigraphic position of the Potsdam sandstone, the author gives a section from Isle Jesus to the St. Louis River, showing the geological formations from the gneiss to the Utica slate, and lists a few fossils from the Chazy. A geological map which shows well the formations in the Ottawa basin is appended.

1855. EMMONS, EBENEZER. *American Geology*. In this work Emmons still retains a part of the Chazy formation in the Calciferous. The following section at Chazy is given :

1. Silico-calcareous beds, more or less interspersed with sparry masses, thirty to thirty-five feet ; fossils rare and more or less cherty.

2. Crinoidal mass composed almost entirely of disjointed and broken columns of encrinites in which plates of the cistidea may be recognized, twenty feet.

3. A dull, gray, earthy mass, ten feet, without fossils, and passing into oölitic beds.

4. Another crinoidal mass similar to the first, though its color is a brighter red.

⁴⁰ Note the spelling adopted by de Verneuil.

5. A mass more or less siliceous, and more massive; it contains the *Isotelus* and *Illænus*, twenty feet.

6. Mineral characters similar to the foregoing; the fossils are mostly Orthidæ, of which individuals of two or three species are very numerous.

7. Red crinoidal mass, with less earthy matter, and is susceptible to a fine polish; fifteen feet thick.

8. Drab-colored, thin-bedded magnesian limestone, suitable for hydraulic lime.

In southwestern Virginia and in Tennessee the Chazy is stated to occupy the same position and carry the same fossils as at Chazy and Essex. Its thickness there is 130 feet.

The following fossils are described:

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|------------------------------------|----------------------------------|
| <i>Orthoceras rectiannulatus</i> , | <i>Atrypa acutirosta</i> , |
| <i>O. subarcuatus</i> , | <i>Atrypa dubia</i> , |
| <i>Maclurea magna</i> , | <i>Orthis costalis</i> , |
| <i>Maclurea sordida</i> , | <i>Strophomena insculpta</i> , |
| <i>Straparollus labiatus</i> , | <i>Strophomena fasciata</i> , |
| <i>Straparollus angulatus</i> , | <i>Stictopora labyrinthica</i> , |
| <i>Scalites angulatus</i> , | <i>Stictopora fenestrata</i> , |
| <i>Raphistoma striata</i> , | <i>Columnaria alveolata</i> , |
| <i>Raphistoma planistria</i> , | <i>Streptoplasma expansa</i> , |
| <i>Raphistoma staminea</i> , | <i>Calastes tenuiradiatus</i> , |
| <i>Pleurotomaria antiquata</i> , | <i>Illænus crassicauda</i> , |
| <i>Bucania sulcata</i> , | <i>Illænus arcturus</i> , |
| <i>Bucania rotundata</i> , | <i>Isotelus canalis</i> , |
| <i>Atrypa plicifera</i> , | <i>Asaphus obtusus</i> , |
| <i>Atrypa plena</i> , | <i>Asaphus marginalis</i> . |
| <i>Atrypa altilis</i> , | |

1855. MARCOU, JULES. *Resumé Explicatif d'une Carte Géologique des Etats-Unis et des Provinces Anglaises de l'Amerique du Nord, avec un Profil Geologique Allant de la Vallée du Mississippi aux Côtes du Pacifique, et une Planche de Fossiles.* Bulletin of the Geological Society of France, 2d series, Vol. 12, pt. 2, pp. 813-914.

In the "silurian moyen," Marcou places: first, the Chazy or Isle La Motte limestone; second, Birdseye limestone; third, Black River limestone; fourth, Trenton limestone; fifth, Utica slate; and sixth, Hudson River group. Among the principal fossils *Maclurea magna* is listed.

1858. BIGSBY, DR. J. J. On the Paleozoic Basin of the State of New York. Part 1. Quarterly Journal of the Geological Society of London, Vol. XIV, 332, pt. 2, p. 427, pt. 3, Vol. XV, p. 251.

The thickness of the *Chazy or Black River Limestone*, including the Birdseye, is given at 130 feet.

Sixty-three fossils are listed, divided among the groups as follows: Zoöphyta 5, Bryozoa 5, Echinodermata 3, Brachiopoda 12, Monomyaria 1, Crustacea 6, Gastropoda 14, Cephalopoda 17. This list, however, contains

several species which properly belong to the Trenton, and a few which must have been incorrectly determined.

1858. BILLINGS, E. On the Cystidæ of the Lower Silurian Rocks of Canada. Canadian Geological Survey, Decade 3, p. 9.

In this paper several cystids from the Chazy formation about Montreal are described.

1858. JONES, T. R. On the Paleozoic Bivalve Entomostraca of Canada. Canadian Geological Survey, Decade 3, p. 91.

Several species of ostracods from the Chazy of the Ottawa Valley are described.

1859. BILLINGS, E. On the Crinoidea of the Lower Silurian Rocks of Canada. Canadian Geological Survey, Decade 4.

The author describes a few species of crinoids from the Chazy formation near Montreal, Canada.

1859. BILLINGS, E. Descriptions of Some New Species of Trilobites from the Lower and Middle Silurian Rocks of Canada. Canadian Naturalist and Geologist, Vol. 4, pp. 367-383.

Describes and figures three new Chazy trilobites.

1859. BILLINGS, E. The Fossils of the Chazy Limestone with Descriptions of New Species. Canadian Naturalist and Geologist, Vol. 4, pp. 426 to 470.

In this most important paper a large number of new species are described. Billings gives the total of Chazy species then known as 129, distributed among the following classes: Zoöphyta 6, Cystidea 7, Crinoidea 14, Brachiopoda 21, Bryozoa 4, Lamellibranchiata 17, Gastropoda 21, Heteropoda 5, Cephalopoda 15, Trilobita 14, Entomostraca 4, Serpulites 1.

The genera, with the exception of some of the Cystidea and Crinoidea, all pass upward into the more recent formations. *Malocystites* and *Paleocystites* are peculiar to the Chazy, as are *Palæocrinus*, *Pachyocrinus* and *Blastoidocrinus*. It is stated that 21 species pass into higher formations.

1859. SALTER, J. W. On the Fossils of the Lingula Flags, or "Zone Primordiale." Quarterly Journal of the Geological Society of London, Vol. XV, p. 551.

Under the title of *Asaphus* (or *Olenus*?) Salter describes and figures a trilobite from the sandstone of the Ottawa Valley, Canada, which trilobite Billings described in the same year as *Bathyrurus angelini*.

1861. BILLINGS, E. On Some New or Little Known Species of Lower Silurian Fossils from the Potsdam Group (Primordial Zone). Report of the Geology of Vermont, Vol. 2, pp. 942-960.

Describes *Ampyx halli*, from Highgate Springs, Vermont. The same article is reprinted in Paleozoic Fossils of Canada, Vol. 1, 1865.

1861. HITCHCOCK, E., ET AL. Geology of Vermont, Vol. 1, pp. 272-280.

In this report E. Hitchcock gives the lithological characters, range, thickness and fossils of the Chazy limestone in Vermont. The Black River limestone is included in the Chazy in some of the descriptions, and in some cases

parts of the Chazy are referred to the Birdseye limestone. The following fossils are listed from Vermont localities:

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|-------------------------------|------------------------------|
| <i>Phytopsis tubulosum</i> , | <i>Maclurea magna</i> , |
| <i>Rhynchonella altilis</i> , | <i>Cyrtoceras</i> , |
| <i>Rhynchonella plena</i> , | <i>Bucania</i> , |
| <i>Chonetes</i> , | <i>Illænus crassicauda</i> , |
| <i>Calymene multicosta</i> , | <i>Illænus</i> . |

The thickness is estimated at 300 feet.

"The Chazy covers more surface in Vermont than any other of the Lower Silurian limestones, and it seems to be one of the thickest."

The range of the Chazy formation in the state is given as follows:

"It is not found south of Benson, and appears next at Larrabee's Point, being very thin at both places. Curving at Larrabee's Point, it crosses into New York, where it appears at Crown Point, but crosses back to Vermont at Chimney Point. An anticlinal commences here, extending through the western part of Addison County to Charlotte, then the formation goes under the lake to Valcour Island and South Hero. In Vermont the most northern exposure is at Isle La Motte."

1863. BILLINGS, E. On the Parallelism of the Quebec Group with the Llandeilo of England and Australia, and with the Chazy and Calciferous Formations. Canadian Naturalist and Geologist, Vol. 8, pp. 19-35.

In this paper Mr. Billings discusses the position of the Quebec group and places it as equivalent to the upper part of the Calciferous and all of the Chazy. The following quotations are of interest:

"In 1859 I made an examination of all the Calciferous and Chazy fossils, in the Provincial Museum, and found that there were 41 species of the former and 129 of the latter, but not one species was clearly identified as common to the two formations." . . . "I think it probable that a large portion of the Quebec group is of an age between the Calciferous and Chazy. But I do not believe that this would be sufficient to account for so great a number of species distinct from those of these two formations. The existence of zoölogical provinces in the Silurian seas, although not clearly proved, is something that should always be kept in mind. . . . There is here another break (between the Chazy and Black River), but not so decided as between the Calciferous and Chazy."

1863. LOGAN, SIR WILLIAM E. Geology of Canada, pp. 123-135.

In the chapter on the Chazy formation in Canada Sir William Logan gives in detail its distribution and characters in the region about Montreal and in the Ottawa Valley. The thickness of the formation is given at about 300 feet. It is noted that from St. Lin and Industry to the Mingan Islands, a distance of five hundred miles, the Chazy is not exposed.

On pp. 294-296 the conditions of deposition are discussed. The author suggests that the Cambrian and Ordovician were laid down in a sea which had a steeply sloping coast, but with a shelf near shore. The Potsdam sandstone was a littoral deposit on the shelf, while the Georgian was de-

posited in the deep sea not far from shore. Then shortly after the beginning of Calciferous time, a great continental elevation occurred carrying the Potsdam high above the sea and bringing the areas of the Quebec group near the surface. Then while it was subsiding slowly, the coarse beds of the Quebec group were formed, until the Potsdam was again submerged and the Chazy covered a part of these, and later the Trenton and Hudson River covered all. In that way he explained the break in the succession of life between the Calciferous and Chazy in the shallow water deposits of these formations between Allumette Island and Montreal, as well as in the Mingan Islands. "The break between the Chazy and Trenton is not so great as between the Calciferous and Chazy. It is not yet certain that a single species found in the marginal outcrops of the former formation in Canada passes into the Chazy, while about one sixth of the Chazy species are known to occur in the Birdseye and Black River."

1864. DAWSON, J. W. Canadian Naturalist and Geologist, new series, Vol. 1, pp. 363-458. Attempts to show that *Arthropycus grenvillensis* from the Chazy at Grenville, Canada, is a crustacean burrow.

1865. BILLINGS, E. Paleozoic Fossils of Canada, Vol. 1.

In this volume, published in parts from 1861 to 1865, are described a large number of fossils from the Chazy formation of Canada. This volume, with Decades 3 and 4 of the Geological Survey of Canada, and the article in Vol. 4 of the Canadian Naturalist and Geologist, contain the greater part of the contributions to the paleontology of the Chazy Limestone since the publication of Volume I of the New York State Paleontology, 1847.

1869. SAFFORD, J. M. Geology of Tennessee, pp. 228-236.

Professor Safford correlated the *Blue* or *Maclurea* Limestone of Tennessee with the Chazy and Black River of New York. In the work cited he describes the lithological character, thickness, distribution, and fossils of that limestone.

1872. BILLINGS, E. Fossils, Probably Chazy, in the Eolian Limestone of West Rutland. American Journal of Science and Arts, third series, Vol. 4, p. 133.

In a letter to Prof. James D. Dana, Mr. Billings states that he has recently received from the Rev. A. Wing, fossils from the marble quarries of West Rutland, and he believes them to be Chazy. The fossils "consist of numerous obscurely preserved forms like *Pleurotomaria staminea*, small encrinral joints, and a single plate of *Palaeocystites tenuiradiatus*."

1879. HALL, C. E. Laurentian Magnetite Iron-ore Deposits of Northern New York. Thirty-second Annual Report New York State Museum Natural History, pp. 133-140.

Mentions the occurrence of a Chazy outlier at Schroon Lake Post Office, ten miles from the nearest outcrop of sedimentary rocks.

Note — Kemp refers this to the Calciferous, but found no fossils.

1879. HINDE, G. J. On Conodonts from the Chazy and Cincinnati Group of the Cambro-Silurian and from the Hamilton and Genesee-Shale Division of the

Devonian, in Canada and the United States. Quarterly Journal of the Geological Society of London, Vol. 35, p. 351.

The author describes *Prioniodus radicans*, which is said to occur in large numbers in a bed of dark limestone of the Chazy at Grenville, Canada. It is associated with great numbers of tests of *Lep rditia*.

1879. WALCOTT, C. D. New Species of Trilobites from the Chazy and Trenton Formations. Thirty-first Annual Report New York State Museum, page 68.

Describes one new trilobite from the Chazy limestone at Chazy, New York.

1879. WHITFIELD, R. P. The Discovery of Specimens of *Maclurea magna*, of the Chazy, in the Barnegat Limestone, near Newburgh, New York. American Journal of Science and Arts, third series, Vol. 18, p. 227.

In a letter to Professor James D. Dana, Professor Whitfield states that he found three specimens of *Maclurea magna* in a quarry one and three fourth miles southwest of Newburgh ferry.

1881. MARCOU, JULES. Sur les Colonies dans les Roches Taconiques des Bords du Lac Champlain. Bulletin of the Geological Society of France, third series, Vol. 9, pp. 18-46.

In this article the geology of several Vermont towns is described. A brecciated limestone at Highgate Springs, Vermont, yielded Marcou the following Chazy fossils:

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|-----------------------|----------------------|
| <i>Amplex halli</i> , | <i>Orthoceras</i> , |
| <i>Lingula</i> , | <i>Murchisonia</i> , |
| <i>Orthis</i> , | <i>Columnaria</i> . |

The Chazy limestone in New York is stated to have a thickness of 100 meters, and the limestones are very fossiliferous, especially rich in brachiopods, *Maclurea*, and the remains of crinoids.

On the map which accompanies the article, the Chazy is represented as covering the southern half of Isle La Motte, and forming a narrow strip running south from Chazy, turning east and reaching the lake four or five miles south of Chazy Landing.

1881. MILLER, S. A. Observations on the Unification of Geological Nomenclature, with Special Reference to the Silurian Formation of North America. Journal of the Cincinnati Society of Natural History, Vol. 4, p. 267.

Gives the distribution of the formation and mentions some of the fossils.

1881. WHITFIELD, R. P. Notice of the Geological Investigations along the Eastern Shore of Lake Champlain, Conducted by Professor H. M. Seely and President Ezra Brainerd, of Middlebury College, with Description of New Fossils Found. Bulletin American Museum Natural History, Vol. 1, p. 293.

In this paper two new Chazy fossils are described. Some remarks on the Chazy of western Vermont are also made.

1884. AMI, H. M. A Classified List of the Cambro-Silurian and Post Tertiary Fossils from Ottawa and Vicinity. Extract from Transactions, No. 5, Ottawa Field Naturalists Club.

Not seen.

1885. SEELY, H. M. A new Genus of Chazy Sponges, *Strephochetus*. *American Journal of Science and Arts*, Vol. 30, third series, p. 357.
In this paper is described a new genus of free calcareous sponges, composed of concentric layers containing minute twining canals.
1886. WALCOTT, CHARLES D. Second Contribution to the Studies of the Cambrian Faunas of North America. *Bulletin of the United States Geological Survey*, No. 30.
Refers to the Chazy formation in its relation to the Cambrian and to the Quebec group.
1887. AMI, H. M. On the Occurrence of *Scolithus* in the Rocks of the Chazy Formation about Ottawa, Canada. *Ottawa Naturalist*, Vol. 1, pp. 65-74, 81-88.
Not seen.
1888. AMI, H. M., and SOWTER, T. W. E. The Chazy Formation at Aylmer, P. Q. *Ottawa Naturalist*, Vol. 2, No. 1, pp. 11-15.
Not seen.
1888. BRAINERD, EZRA, and SEELY, H. M. The Original Chazy Rocks. *American Geologist*, Vol 2, p. 323.
In this paper the authors give a detailed section and map of the outcrops of the Chazy at the typical locality, Chazy, New York. The thickness of the formation there is stated at 740 feet. This is the first paper to give the true thickness of the formation.
1890. DAWSON, J. W. On Burrows and Tracts of Invertebrate Animals in Paleozoic Rocks and Other Markings. *Quarterly Journal of the Geological Society*, Vol. 46, pp. 595-617.
Describes and figures *Rusichnites grenvillensis* which he attempts to show is a crustacean burrow. The specimen is from the Chazy formation at the Grenville Canal, Canada.
1891. BRAINERD, EZRA. The Chazy Formation in the Champlain Valley. *Bulletin of the Geological Society of America*, Vol. 2, pp. 293-300.
The author gives detailed accounts of the sections at Valcour Island, Isle La Motte, and Crown Point, and makes observations on the Chazy, Highgate, St. Armand, and Cornwall sections. The thickness of the formation is greatest at Valcour Island, where it reaches 890 feet, and decreases toward the south, being 305 feet at Crown Point and 59 feet at Orwell.
This paper is of the utmost importance and certain portions will be quoted :
"Along its western border (Lake Champlain) are steep, high hills of Archean, apparently the former shore of the old Silurian sea." . . . "Westward from Cornwall, toward Lake Champlain, the beds of the Chazy rapidly decrease in thickness. The same fact is noticeable southward from Valcour Island along the lake shore. The top and bottom of the formation are the first to disappear. Neither the '*Rhynchonella*' beds nor the 'slaty limestone' are to be seen south of Valcour. The Lower Chazy and Upper Chazy contract to small proportions and finally disappear. Then the Middle Chazy begins to contract, and also disappears."

" . . . West and south of this point, through Central New York and the tract west of the Adirondack region as far north as the Thousand Islands, the Chazy is altogether lacking. When it reappears to the northward, along the Ottawa River and the vicinity of Montreal, it apparently consists of the measures which first disappear to the south in the Champlain Valley. They are described by Logan as whitish sandstones interstratified with bands of green shale, followed by beds 'composed almost entirely of *Rhynchonella plena*' and are supposed not to exceed 150 feet in thickness. This answers well to the top and bottom of the Valcour Island section. No beds containing *Maclurea magna* are reported from Canada to the west of the outlet of Lake Champlain. These facts could easily be accounted for by supposing at the north an elevation of the sea bed during the middle of the Chazy period, and at the south a simultaneous depression and submergence. If in the intervening region the submergence was continuous, we should have the whole formation and the maximum thickness at the northern end of Lake Champlain."

1891. JONES, T. R. On some Ostracoda from the Cambro-Silurian, Silurian, and Devonian Rocks. Contributions to Canadian Micro-Paleontology, pt. 3.

The following new species of Ostracoda from the Chazy formation of the Ottawa Valley are described:

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| <i>Beyrichia clavigera</i> , | <i>Ischilina labellosa</i> , |
| <i>Beyrichia clavigera clavifracta</i> , | <i>Leperditia balthica primæva</i> . |
| <i>Ischilina ottawa intermedia</i> , | |

1893. AMI, H. M. On the Geology and Paleontology of the Rockland Quarries and Vicinity in the County of Russell, Ontario, Canada. Ottawa Naturalist, Vol. 7, pp. 138-147.

Describes the Chazy in the vicinity of Rockland.

1894. AMI, H. M. Lists of fossils. Appendix to Report J, Vol. 7, Geological Survey of Canada, pp. 113-156.

Gives numerous lists of fossils from localities in the Southwest sheet of the "Eastern Townships" map. These lists are quoted in the preceding pages.

1894. CUSHING, H. P. Preliminary report on the Geology of Clinton County, New York. 47th Annual Report New York State Museum, pp. 669-683.

1894. ELLS, R. W. Report on a Portion of the Province of Quebec Comprised in the Southwest Sheet of the "Eastern Townships" Map. Geological Survey of Canada, Vol. 7, pp. 5-9.

"In the Phillipsburg section there are no sandy or shaly beds at the base of the Chazy. This may be accounted for on the assumption that a fault has cut off the lower beds, of which there does not appear to be any clear evidence, or that instead of littoral deposits as in the Ottawa Valley, the deposition was for the most part in deep water and the sediments almost entirely calcareous." . . . "The Chazy forms a syncline at Phillipsburg and to the north it is a limestone, limestone conglomerate and slate, and is very rich in fossils, more particularly in the northern portions of the belt about

two miles north of Mystic. The most western outcrop of the Chazy conglomerate is on the road from Standbridge to Bedford. Most of the pebbles show that they were derived from the Calciferous of the Phillipsburg and Saint Armand section, and the fossils in the paste show that the rocks themselves are the equivalents of the Chazy."

1894. KEMP, J. F. Preliminary report on the geology of Essex County, New York. New York State Museum, 47th Annual Report, pp. 627-666.

1895. CUSHING, H. P. The Faults of Chazy Township, New York. Bulletin of the Geological Society of America, Vol. 6, pp. 285-296, pl. 12.

The writer gives an excellent account of the structure of the formations exhibited at Chazy, New York, with map.

1895. KEMP, J. F. The Geology of Moriah and Westport Townships, Essex County, New York. Bulletin of the New York State Museum, Vol. 3, No. 14, pp. 325-355.

Mentions the occurrence of the Chazy in these townships and gives geologic map.

1896. AMI, H. M. Notes on Some of the Fossil Organic Remains Comprised in the Geological Formations and Outliers of the Ottawa Palæozoic Basin. Transactions of the Royal Society of Canada, second series, Vol. 2, p. 151.

Lists some of the characteristic Chazy fossils.

1896. BRAINERD, EZRA, and SEELY, H. M. The Chazy of Lake Champlain. Bulletin of the American Museum of Natural History, Vol. VIII, p. 305.

The authors give detailed sections and geological maps of the Chazy formation at Valcour Island, Isle La Motte, and Crown Point.

1896. ELLS, R. W. The Palæozoic Outliers in the Ottawa River Basin. Transactions of the Royal Society of Canada, Vol. 2, second series, pp. 137-150.

The Chazy is separable into two portions, the lower shaly and sandy, the upper largely calcareous. The lowest consists of a coarse greenish-gray grit or sandstone, in some places conglomeratic in character. These have a thickness of only a few feet, and graduate upward into fine arenaceous beds, with a considerable thickness of shales. Intercalated beds of limestone occur in the upper part, which gradually becomes more calcareous until the formation is essentially a limestone. At Aylmer the thickness of the lower portion of the Chazy is not far from 100 to 120 feet.

The thickness of the upper or calcareous portion varies greatly at different places, ranging from 50 to nearly 100 feet. In its upper part the limestones become nodular and contains beds of grayish color which are largely composed of *Rhynchonella plena*.

The passage from the upper beds of the Chazy to the overlying beds of Birdseye and Black River appears to be gradual and to present no well-defined break in the succession of the strata.

1896. WHITE, THEODORE G. Geology of Essex and Willsboro Townships, Essex County, New York. Transactions New York Academy of Science, Vol. 13, pp. 214-233, 1896.

The Chazy formation in these townships is rather heavy-bedded and the layers are much used as a building stone. The following fossils, identified by Gilbert Van Ingen, are listed:

| | |
|--------------------------------------|---------------------------------|
| <i>Maclurea magna</i> , | ? <i>Orthis perveta</i> , |
| <i>Orthoceras</i> sp., | <i>Orthis platys</i> , |
| ? <i>Monticulipora lycopodites</i> , | <i>Strophomena incrassata</i> , |
| <i>Orthis borealis</i> , | <i>Strophomena alternata</i> , |
| <i>Orthis imperator</i> , | <i>Solenopora compacta</i> , |
| ? <i>Orthis costalis</i> , | <i>Stenopora fibrosa</i> , |
| ? <i>Ophileta complanata</i> , | <i>Asaphus</i> sp. ? fragments, |
| <i>Lituites</i> sp. ? | <i>Trilobite</i> , fragments, |
| <i>Bolboporites americanus</i> , | <i>Zaphrentis</i> , |
| <i>Camarella varians</i> , | Encrinal columns. |
| <i>Camarella</i> sp. | |

Globular masses containing as nuclei minute lamellar foraminiferal skeletons.

1897. KEMP, J. F. The Geology of Moriah and Westport Townships, Essex County, New York, with a Geologic Map. 48th Annual Report New York State Museum, Vol. 1, Appendix, pp. 325-355.

1897. KEMP, J. F. Physiography of the Eastern Adirondacks in the Cambrian and Ordovician Periods. Bulletin of the Geological Society of America, Vol. 8, p. 408.

In this paper Professor Kemp brings together all possible evidence of the physiography of what he calls the Adirondack Island of early Paleozoic times. The following are the most interesting statements.

"It is evident that the Lower and Middle Cambrian strata were laid down well to the east of the present limits of the crystallines and that with their gradual subsidence the Cambrian sea crept westward, so that the Potsdam sandstones were deposited along an encroaching shore line."

Continuing, the writer describes many valleys and depressions in which the strata are Potsdam or Beekmantown, while the crystallines rise high above them. He considers these to be prepaleozoic depressions which were occupied by arms of the sea during the paleozoic. Some outliers twelve to twenty miles from the lake show the former extent of these depressions. In the depressions on the southern and southeastern sides the Trenton extends further into the mountains than the other formations.

As an alternative hypothesis, Kemp says it is necessary to assume that the Adirondack region was a peneplain in later Cambrian time and the Cambrian and Ordovician sea spread over it. All rocks then deposited must have been removed except these small remnants which have been dropped by great faults and so preserved in the fault valleys. Although the faults are recognized as strong factors in the topography, the embayment theory seems to him more probable.

1897. MARCOU, JULES. Rules and Misrules in Stratigraphic Classification. American Geologist, Vol. 19, pp. 35-49, 111-131.

In this paper Mr. Marcou gives the following sections at Chazy, evidently following Emmon's ideas of 1842 and 1855.

"In discordance on the Potsdam we see about 250 feet of Calciferous sandrock, containing four or five species of fossils, such as *Orthis*, *Strophomena*, *Scalites*, and numerous fragments of crinoids.

"Above it we have the Chazy limestone; about 200 feet in thickness, containing a quantity of fossils, such as *Maclurea magna*, *Bellerophon*, *Asaphus*, *Stenopora*, *Orthoceras*, *Rhynchonella*, crinoid stems, etc.

"Then comes the Birdseye limestone and Black River formation, called also the Black Marble of Isle La Motte; thickness about 40 feet, containing fossils belonging to *Isotelus*, *Orthoceras*, *Maclurea*, *Leptæna*, etc."

1897. WHITFIELD, R. P. Description of New Species of Silurian Fossils from near Fort Cassin and Elsewhere on Lake Champlain. Bulletin of the American Museum of Natural History, Vol. IX, pp. 177-184.

Describes a new gastropod from the Chazy formation on Valcour Island.

1898. CUSHING, H. P. The Geology of Clinton County, New York. Report of the New York State Geologist, 1895, pp. 503-573.

In this paper the Chazy outcrops in Clinton County are described and mapped. The formation is divided into three divisions, A, B and C, following Brainerd and Seely.

1898. ELLS, R. W. Formations, Faults, and Folds of the Ottawa district (Canada). Ottawa Naturalist, Vol. XI, pp. 177-189.

Not seen.

1898. MERRILL, F. J. H. A Guide to the Study of the Geological Collections of the New York State Museum. Bulletin of the New York State Museum, Vol. 4, No. 19.

In this bulletin the Chazy is considered the lowest member of the Trenton group. The thickness of the formation is given as 730 feet. The classification used is as follows:

| System. | Group. | Stage. |
|-----------------|------------------|------------------------|
| Lower Silurian. | 3. Hudson River. | 1. Hudson River shale. |
| | | 2. Utica shale. |
| | 2. Trenton. | 4. Trenton. |
| | | 3. Black River. |
| | | 2. Birdseye. |
| | | 1. Chazy. |
| | 1. Calciferous. | |

1899. AMI, H. M. Lists of Fossils. Appendix to Report J, Vol. 12, 1899, Geological Survey of Canada, p. 139.

Lists many fossils from localities in the Ottawa Valley. Some of these lists have been used in the preceding pages.

1899. CLARKE, JOHN M., and SCHUCHERT, CHARLES. The Nomenclature of the New York Series of Geological Formations. Science, new series, Vol. X, pp. 874-878.

The Chazy is put with the Beekmantown in the Canadian.

1899. ELLS, R. W. Report on the Geology of Argenteuil, Ottawa, and a Part of Pontiac, Counties. Geological Survey of Canada, Vol. XII, Report J.

"The fossiliferous sediments along the lower Ottawa have evidently been deposited in an estuary of the old valley of that river, which must have been well defined at an early date, and shortly after the deposition of the Grenville series. The northern limit of the Palæozoic sea is defined by a bold series of hills, which extend along the north side of the Ottawa from Ottawa City to Saint Jerome, situated to the northwest of Montreal, while the southern and western limit is roughly indicated by the areas of crystalline rocks, the eastern boundary of which can be followed from Arnprior to the City of Brockville on the St. Lawrence River.

"These newer formations must, however, at one time have had a much wider extension than we find at the present time, since over a large area of crystalline rocks to the west, scattered outliers of fossiliferous sediments occur, as limestones of Black River and Trenton age, and also of Utica shales, throughout the upper part of the Ottawa basin, reaching an elevation of nearly 800 feet above the present sea level."

1900. AMI, H. M. On the Geology of the Principal Cities in Eastern Canada. Transactions of the Royal Society of Canada, Vol. 6, Second Series, Sec. 4, p. 125.

Ottawa.—The Chazy formation is here divisible into three series of strata. The lowest arenaceous shales and sandstones which are often calcareous; the intermediate, formed of variously colored bands of shale holding phosphatic nodules; the upper, formed of marine limestones holding innumerable quantities of ostracods. The entire formation is not over 200 feet thick.

Montreal.—The formation consists of light and dark-gray crystalline limestone between 200 and 300 feet thick.

Some fossils are listed from both cities.

1900. CLARKE, JOHN M., and SCHUCHERT, CHARLES. The Nomenclature of the New York Series of Geological Formations. American Geologist, Vol. XXV, pp. 114-119.

1900. ELLS, R. W. The Physical Features and Geology of the Palæozoic Basin, between the Lower Ottawa and St. Lawrence Rivers. Transactions of the Royal Society of Canada, Vol. 6, Second Series, Sec. 4, p. 99.

This paper gives about the same data in regard to the Chazy as the paper by the same author published in 1896.

1900. WHITE, THEODORE G. The Upper Ordovician Faunas in the Lake Champlain Valley. Bulletin of the Geological Society of America, Vol. 10, pp. 452-462.

This paper treats primarily of the Black River, Trenton, and Utica formations, but the following interesting references are made to the Chazy:

"The capping bed of the underlying Chazy, where well exposed, seems to be a very constant and characteristic layer of fine-grained sandstone or quartzite. It is particularly well shown at Valcour Island and Crown Point

and seems to indicate a retreating sea at the close of the period immediately preceding the deposition of the Black River strata." . . . "At Larrabee's Point, over forty feet of Calciferous and Chazy limestones occur in proximity to the base of the section, but the transition beds to the base of the Black River are not shown." . . . "At the southern end of South Hero, Grand Isle, is an extensive anticline which exhibits . . . the entire section of the Chazy."

1902. PERKINS, GEO. H. The Geology of Grand Isle. Report of the Vermont State Geologist, New Series, No. 3, p. 102.

This article describes in detail the outcrops of the Chazy formation found on Grand Isle. The layers do not seem to be greatly tilted, the dip rarely exceeding 10° to 15° , and is often less; but there are pronounced faults. The upper beds are best exposed and are full of *Camarotachia plena*. The lowest beds are thus described: "A mile northeast from Phelps Point is a hill 150 feet above the lake, where the lower beds are well shown. Before reaching this hill, not far east of the wagon road, there is a small outcrop of the very lowest beds of the Chazy. These beds are very hard, yellow when weathered, but dark-gray when freshly broken. There are here in all not over four feet of rock. Most of it is not fossiliferous, but a few layers contain an abundance of a large and probably undescribed *Lingula*."

1902. RAYMOND, P. E. The Crown Point Section. Bulletin of American Paleontology, No. 14.

In this paper a detailed section of the Chazy strata at Crown Point is described, and many fossils listed. Four new species of Chazy fossils are described, one of which, *Triplecia gracilis*, is a synonym for *Camerella longirostris* Billings.

1902. SEELY, H. M. Some Sponges of the Chazy Formation. Report of the Vermont State Geologist, New Series, Vol. 3, p. 151.

In this paper several new species of sponge-like forms from the Chazy are described. The species occur at Grand Isle and Isle La Motte, Vermont, and Chazy, New York.

1902. ULRICH, E. O., and SCHUCHERT, C. Paleozoic Seas and Barriers. Report of the New York State Paleontologist, Bulletin 52 of the New York State Museum, p. 633.

In this extremely suggestive paper, it is attempted to show by the geographic distribution and faunal relations that the Chazy rocks were deposited in a narrow bay which forked, one branch extending up the Ottawa Valley and the other down the Champlain Valley, the open sea being to the east. The following quotation seems to show their views of the basins in which the Chazy formation was deposited.

"With the earlier part of this subsidence, the Atlantic invaded the continent westward by means of the two subparallel and closely approximated channels that we have called the Chazy Bay and Levis Channel. The former extended along the northwestern side of the Quebec barrier, which

separated the two channels, up the St. Lawrence to the northeast angle of the Adirondack mass, where it divided, one arm entering the Ottawa basin, the other passing on up the Champlain Valley to or about Westhaven. The typical Chazy formation, which represents the deposits of this bay, bears evidence in its members of having encroached southward and westward in its arms, the latest beds, except where, apparently, they were removed before being covered by the next formation, extending farthest south and west."

1903. SHIMER, HERVEY W. Columbia University Geological Department—Account of Summer Field Work—American Geologist, Vol. 32, p. 130.

In describing the formations to be seen at Larrabee's Point, Mr. Shimer says:

"Upon the Beekmantown rests the Chazy, a dark, heavy-bedded limestone forty to fifty feet thick. This contains many fossils, the most characteristic of which is *Maclurea magna*. The rock also contains very many *Orthoceras* and *Cyrtoceras* shells."

1904. PERKINS, GEORGE H. The Geology of Grand Isle County. Report of the Vermont State Geologist, New Series, Vol. 4, p. 103.

In this report the Chazy outcrops of the whole of Grand Isle County are described. The most important part is the detailed description of the formation as it occurs at Isle La Motte. On this island the lower and middle beds are well exposed, while the upper part of the formation is covered by a marsh. On the south end of the island the contact of the Beekmantown and Chazy is well exposed, the lowest Chazy being characterized by a large *Lingula* while the upper Beekmantown contains an *Isochilina* known to occur in that horizon in other localities.

1904. SEELY, H. M. The Stromatoceria of Isle La Motte, Vermont. Report of the Vermont State Geologist, New Series, Vol. 4, p. 144.

In this paper Professor Seely describes *Stromatocerium lamottense* n. s. and its variety *Chazyanum*, *Stromatocerium ? moniliferum* n. s. and *Cryptozoon ? perkinsi* n. s. from the Chazy formation at Isle La Motte, Vt., and Chazy, N. Y.

1905. CUSHING, H. P. Geology of the Vicinity of Little Falls, Herkimer County. Bulletin of the New York State Museum, No. 77, January, 1905.

The absence of the Chazy formation in the Mohawk Valley is said to be due to a progressively diminishing rate of subsidence from north to south.

1905. RAYMOND, P. E. The Trilobites of the Chazy Limestone. Annals of the Carnegie Museum, Vol. 3, pp. 328-386, March, 1905.

In this paper are described and figured all the previously known species of trilobites from the Chazy formation, together with a number of new species. Since its publication, *Pseudosphærexochus mars* (Hudson) and *Helionera sol* (Billings) have been added to the Chazy trilobite fauna.

1905. HUDSON, GEORGE H. Contributions to the Fauna of Chazy Limestone on Valcour Island, Lake Champlain. Report of the New York State Paleontologist for 1903, p. 270, April, 1905.

In this paper the following new species are fully described :

| | |
|---|---------------------------------|
| <i>Malocystites emmonsii</i> , | <i>Eunema historicum</i> , |
| <i>Lyriocrinus beecheri</i> , | <i>Eunema epitome</i> , |
| <i>Raphanocrinus gemmeus</i> , | <i>Eunema altisulcatum</i> , |
| <i>Carabocrinus geometricus</i> , | <i>Straparollina harpa</i> , |
| <i>Schizambon duplicimuratus</i> , | <i>Subulites raymondi</i> , |
| <i>Syntrophia multicosta</i> , | <i>Holopea microclathrata</i> , |
| <i>Modiolopsis subquadrilateralis</i> , | <i>Cheirurus mars</i> . |
| <i>Cyrtodonta ? lamellosa</i> , | |

1905. CUSHING, H. P. Geology of the Northern Adirondack Region. Bulletin of the New York State Museum, No. 95, October, 1905.

In this important memoir Prof. Cushing describes the geological history of the northern Adirondack region from the Precambrian to recent times. For the three substages of the Chazy, as defined by Brainerd and Seely, he proposes the formational names Day Point limestone or Lower Chazy, Crown Point limestone or Middle Chazy, and Valcour limestone, or Upper Chazy.

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XXI. A NEW AMERICAN CYBELE.

BY J. E. NARRAWAY AND PERCY E. RAYMOND.

American specimens of trilobites of the genus *Cybele* are so extremely rare that a fairly complete individual discovered by the senior writer in the Black River formation near Ottawa, Canada, adds considerably to our knowledge of American forms. Clarke has described a nearly complete specimen of a species of this genus from the Mohawkian of Minnesota (Paleontology of Minnesota, Volume 3, part 2, page 762, 1897); Billings described the pygidium of another species from the Quebec group of Newfoundland (Paleozoic Fossils of Canada, Volume 1, page 292, 1865); Ruedemann described a partial pygidium from the Lower Trenton at Rysedorph Hill, near Albany, New York (Bulletin of the New York State Museum, Number 49, page 66, 1902); and Raymond has described a species from the Chazy formation at Valcour, New York. This last species was also founded on specimens of the pygidium.

The specimen now to be described is more perfectly preserved than any so far found, except the one described by Clarke, from Minnesota, and fortunately preserves the glabella, a portion not previously recognized in American forms of this genus.¹ This specimen, which is a little less than five-eighths of an inch in length, shows the glabella and the outline of one side of the cephalon, a large part of the free and fixed cheek having been chipped off. The axial lobe is complete, but about half of the left pleuron is gone, the fracture being at a low angle with the axis, and not far from the axial lobe. The first six segments of the thorax have also been somewhat damaged on the right side. The pygidium is complete except for a small loss at the distal end. All the important points, except the position of the eye and the

¹ *Encrinurus mirus* Billings, which was the first American species of *Cybele* described (see locality cited above) was founded on detached glabellæ and pygidia. The pygidium is undoubtedly that of a *Cybele*, but there is some doubt about the cranidium. If it really is that of a *Cybele*, it is distinctly of the European type with three deeply incised glabellar furrows. Dr. Clarke has suggested that this cranidium may belong to a species of *Amphion* (*Pliomera*).

form of the hypostoma, can be made out. It is to be hoped that the attention of collectors may be again directed to these rare trilobites by the recent finds and that more good specimens may be brought to light.



FIG. 1. Dorsal view of the test of a specimen of *Cybele ella* sp. nov. enlarged 7 diameters.

Order PROPARIA Beecher.

Family ENCRINURIDÆ Linnarsson.

***Cybele ella* sp. nov.**

The single specimen now known is 1.4 millimeters long, and the greatest width, at the genal angles of the cephalon is 1.2 millimeters. Test depressed, wide at the genal angles, and tapering rather rapidly to a very small pygidium. Axial lobe narrow, convex, the pleura flattened and curving down abruptly at the sides.

Cephalon short, very wide. Glabella narrow, convex; cheeks depressed convex, lower than the glabella. Length of cephalon, 4 millimeters; width, 12 millimeters.

Glabella narrow behind, expanding toward the front. Glabellar furrows represented by three pairs of pits, the second and third pit on either side united into a long depression parallel to the axis, thus forming side lobes to the glabella. Behind the third pair of pits, representing the third glabellar furrows, are a pair of rather deep pits in the line of the neck furrow. Leading diagonally forward and outward from these pits are narrow depressions which bound the posterior ends of the side lobes of the glabella. The top of the glabella is marked by five pairs of pustules, and on the frontal lobe there are several more, all large and rounded. The larger pustules on the top of the glabella are connected in pairs by slight transverse ridges. On the median line of the glabella, just in front of the first pair of furrows, is a rather large circular pit. Opposite the widest part of the frontal lobe of the glabella there are, on the fixed cheeks, two deep pits not well shown in the figure.

The specimen is broken, so that a large part of both free and fixed cheeks are removed. A part of one free cheek remains, and shows a coarsely reticulated surface. The suture starts very close to the anterior end of the glabella and runs back near the outer margin of the glabella until opposite the first pair of glabellar pits. From that point its course cannot be followed. It cuts the frontal border again a short distance in front of the genal angle. The position of the eye cannot be observed, but it was probably distant from the glabella, as in other species of this genus. Such portions of the fixed cheeks as are preserved are smooth, and sharply differentiated from the free cheeks by the absence of reticulations. The suture is not very sharply impressed. The fixed cheeks are depressed, and separated from the glabellar lobes by a narrow furrow except opposite the first glabellar pits, where there is a transverse ridge extending outwardly upon the cheeks. Around the front of the free cheeks is a narrow, rounded border, and at the genal angle, a large, divergent spine, of which in this specimen only the base is preserved.

Thorax with twelve segments, the sixth one from the front a little wider and more prominent than the others. It does not appear to have borne spines as in *Cybele winchelli*, but the condition of the specimen is not such as to make this point clear. The axial lobe is

prominent, convex, and about one third the width of the thorax. The pleura are flat on the dorsal surface and rather sharply deflected at the sides, where perfect. As shown by the figure, the ends of nearly all the thoracic segments are broken on one side, and of the first five on both sides, so that their terminations cannot be made out. On each side of the axial lobe, each segment bears three pustules, the one nearest the median line being most prominent, while the two which are lower are very faint. The distal portion of each segment bears two or three rather prominent pustules, as do also the ribs on the pleura of the pygidium. On the pleura of the thorax each segment bears a deep groove which divides it into two convex portions. The anterior one is slightly smaller than the posterior in the first six segments, and back of that the two portions become even more differentiated. The posterior portion becomes swollen and somewhat club- or paddle-shaped, while the anterior portion becomes small and slips under the posterior portion of the segment ahead. Where the anterior portion of one segment strikes the posterior portion of the segment ahead, there is a narrow flange on the forward segment. This flange becomes more strongly developed and nearer the axis as the pygidium is approached, and is especially well formed on the back of the twelfth segment. The thorax is 7 millimeters long, 12 millimeters wide at the anterior end, and 5 millimeters wide at the posterior end. The axial lobe is 4.5 millimeters wide at the back of the cephalon, and 1.5 millimeters wide on the twelfth segment.

The pygidium is very small, about as wide as long. The axial lobe is wide and prominent, the pleura narrow and depressed. On the pleura are four pairs of double ribs, the first pair of which are larger than the others, and form a sort of anterior and lateral border to the pygidium. The axial lobe bears five pairs of small pustules, and has fifteen or sixteen transverse furrows which show only on the sides, and do not cross the flattened top. These transverse furrows occur over nearly the whole length of the axial lobe, which does not reach the posterior border of the pygidium. At the posterior end of the median lobe is a rather prominent, unpaired tubercle. The ribs of the pleura bear small tubercles in pairs, and end in short, blunt spines.

Locality. — The specimen here described and figured was found by Mr. J. E. Narraway in the Black River limestone on the Ontario side of the Petite Chaudiere, near Ottawa, Canada, and is in his private collection.

COMPARISON WITH OTHER SPECIES.

The junior writer is glad to take this opportunity to correct an error into which he was led by our lack of knowledge of the glabella of the American forms of *Cybele*. In describing the trilobites of the Chazy formation (ANNALS CARNEGIE MUSEUM, Vol. 3, 1905, p. 362), certain isolated glabellæ and free cheeks of a tribolite found on Valcour Island, and at Valcour, New York, were referred to the genus *Glaphurus* on account of their resemblance to similar parts of *Glaphurus pustulatus*. Now that the glabella of the American *Cybele* is known, it becomes evident that the glabellæ described as *Glaphurus primus* belong to the genus *Cybele*. At Valcour these glabellæ occur associated with the pygidia described under the name of *Cybele valcourensis* by Raymond, and it seems probable that the two parts belong to the same species. *Glaphurus primus* was described before *Cybele valcourensis* and that name must take precedence. The Chazy form should then be known as *Cybele prima*, and the name *Cybele valcourensis* should be eliminated.

Cybele ella is closely related to *Cybele prima* of the Chazy and is very probably a direct descendant, the differences being such as would be expected in an evolutionary series. In the cephalon, *Cybele prima* differs from *Cybele ella* in retaining, faintly it is true, the glabellar furrows, and, in the Chazy species, the pits which represent the inner ends of the furrows are all connected, while in the species just described, only the second and third pits are connected. There seems to be a tendency in several families of trilobites, notably in the Asaphidæ, for the primitive segmentation of the cephalon and pygidium to become obscured, forming, as a result of the process, smooth cephalic and abdominal shields. In these two species of *Cybele*, two stages of a similar process can be seen. In *Cybele prima* the outer ends of the glabellar furrows are becoming faint, and the inner ends are represented by pits. In *Cybele ella* the outer ends are entirely eliminated, and only the pits at the inner ends remain, and these have become smaller by the isolation of the first pair from the succeeding ones.

In the pygidia fewer changes have taken place. The first pair of ribs on the pleura are stronger in *Cybele ella* than in the Chazy species, and the furrows on the sides of the axial lobe are somewhat less prominent.

It is unfortunate that the glabella of *Cybele winchelli* is not known, as that was described from a much larger specimen, and is probably from a higher horizon than any of the other specimens of this genus found in this country. The pygidium of that species differs from the pygidium of *Cybele ella* in lacking the large first rib on the pleura, and in having only a very few furrows on the sides of the axial lobe. Neither does our specimen show any signs of the long spines on the ends of the sixth thoracic segment, but that may be due to imperfections in the material. Both species have rather coarse spines at the genal angles.

From all the Russian species of *Cybele*, our species differs markedly, not only in the presence of a genal spine, but also in the structure of the glabella. With the exception of *Cybele Grevingki* Schmidt, *Cybele Kutorgæ* Schmidt, and *Cybele Revaliensis* Schmidt, all the Russian species have the glabellar furrows sharply impressed. In the three species just mentioned, the glabellar furrows are represented by pits which are nearly isolated, but the pits are not connected as in *Cybele prima* or *Cybele ella*.

Aside from the structure of the glabella, the American and Russian forms are very similar, and, as Ruedemann has remarked, it is probable that the American forms have been developed from European types.

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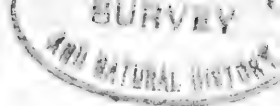
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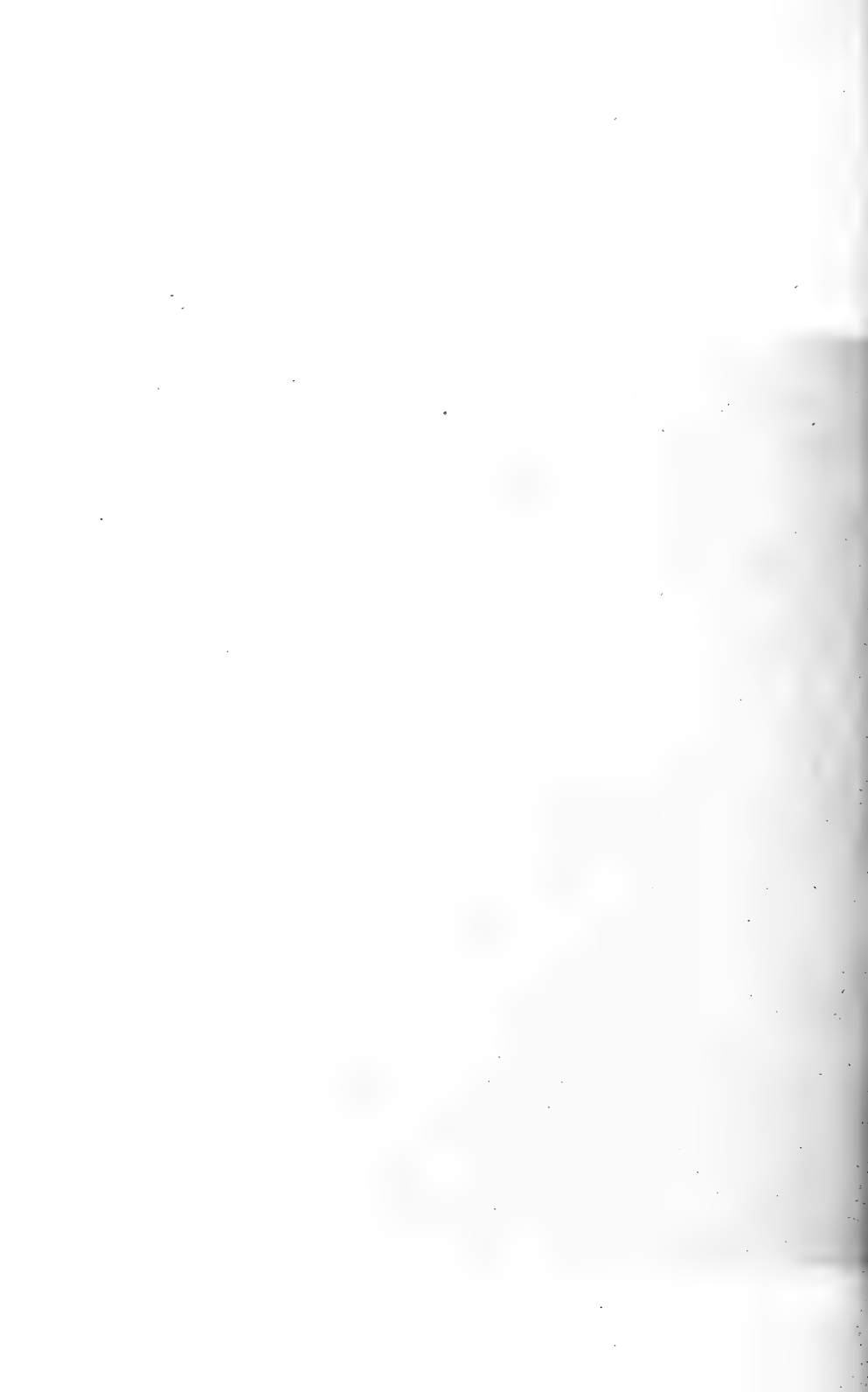
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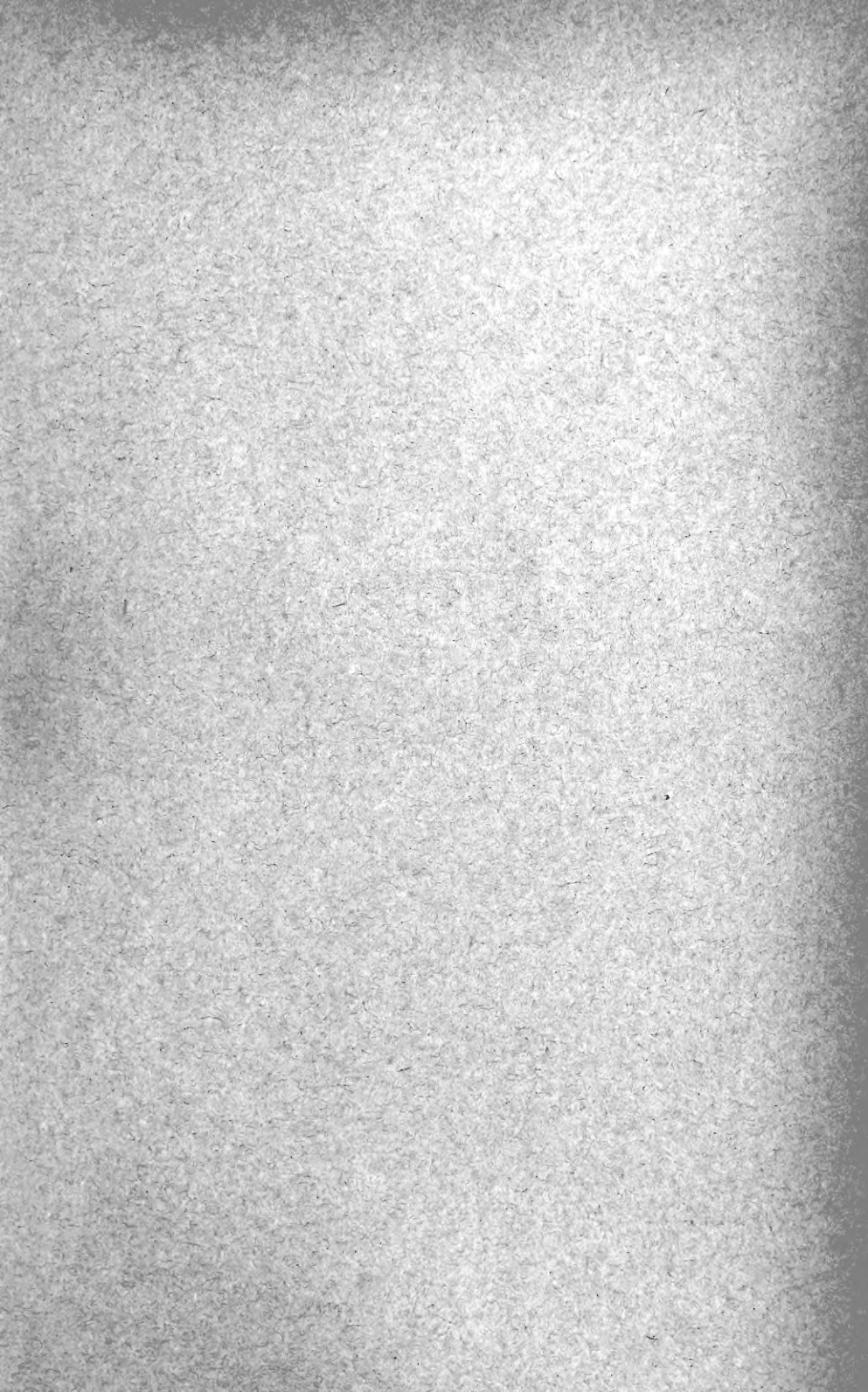
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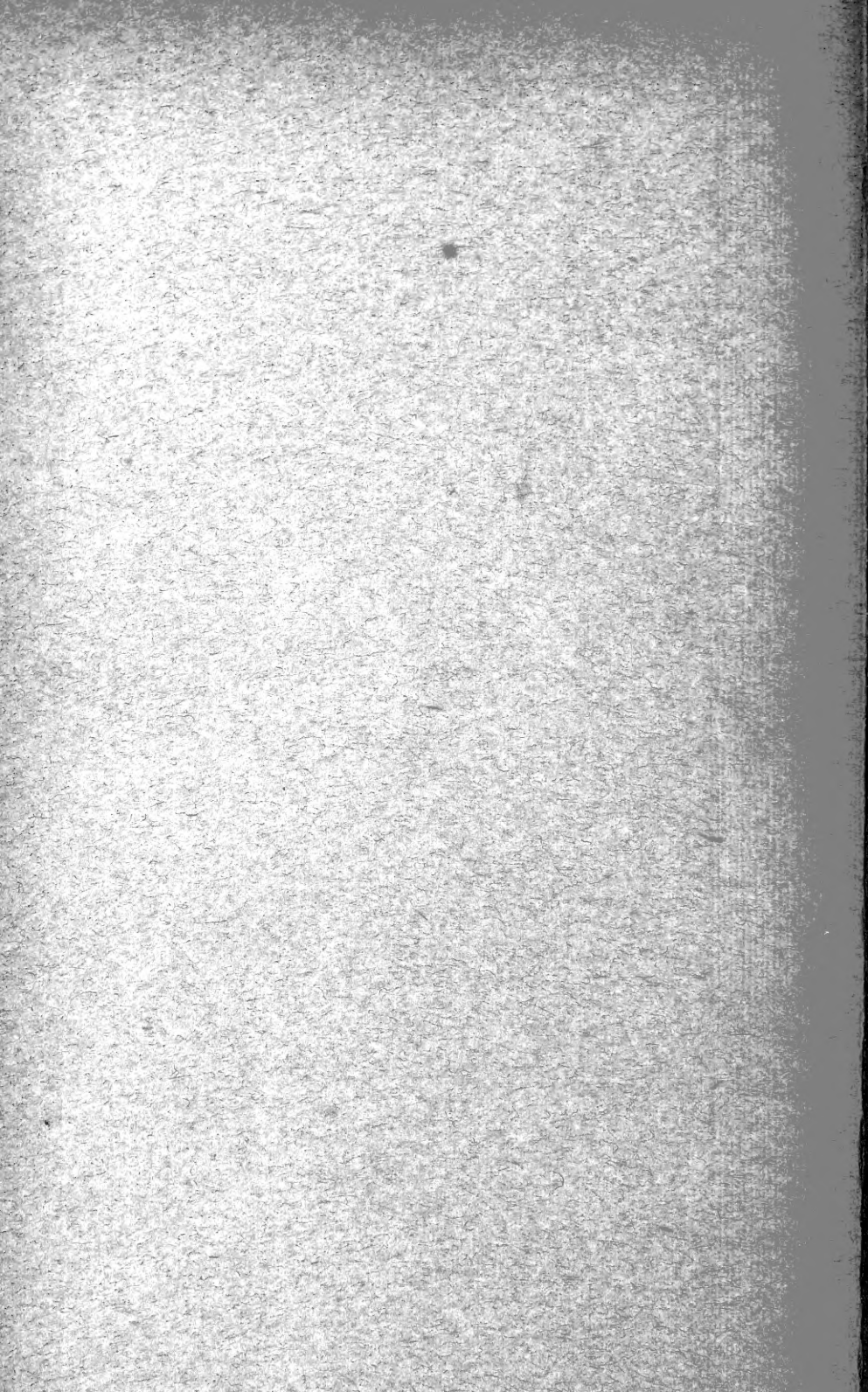
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